UNDERSTANDING INSTITUTIONAL AND SOCIAL FACTORS RELATING TO THE PROVISIONING OF WATER AND SANITATION SERVICES IN RURAL ALASKA: PERSPECTIVES ON COMMUNITY SELF-RELIANCE FROM NINE NATIVE VILLAGES OF INTERIOR ALASKA

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A

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ABSTRACT

The global community acknowledges the essential nature of potable water and proper sanitation to the realization of human rights. Since 1959 federal, state and tribal efforts have focused on the goal of equitably providing these services to Alaska Native villages. However, demographic and geographical realities along with limited resources pose formidable challenges to achieving this lofty goal. This thesis explores the challenges to providing safe drinking water in remote Interior Alaska villages and their impact on self-reliance from the perspectives of knowledgeable village residents. Findings from a grounded theory analysis reveal that despite competence and concerted efforts to meet community needs, social and institutional dimensions pose difficulties to sustainable water services. Such challenges include community perceptions about treated water, communication barriers, unharnessed local expertise and opportunities to develop local capacity, complicated needs assessment and resource acquisition processes, mismatched policies and technology vis-à-vis the realities of village living, and resident out-migration.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

LIST OF APPENDICES

Page

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1. INTRODUCTION

> *"Water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. It is a pre-requisite to the realization of all other human rights."*
>
> —The United Nations Committee on Economic, Cultural and Social Rights, 2002[1]

Area of research

As a global community, we have agreed that securing access to clean water is critical to human life and we have translated this ideal into initiatives at the global level. In July 2010, through Resolution 64/292, the United Nations General Assembly explicitly recognized the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realization of all human rights.[2] Interestingly, the United States was one of the few post-industrialized countries that abstained from voting on the motion. This is not to say that government agencies are not trying to make water and sanitation service available for all communities of this country, however. Most Americans likely imagine that providing clean water and sanitation is simply a matter of injecting funds to cover expenses for acquiring water infrastructure. In reality, the process involved in delivering and sustaining access to this service is far more complicated than one might initially imagine. The research addressed in this thesis focuses on the provision of water and sanitation services in rural Alaska Native villages.

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[1] United Nations Economic and Social Council Committee, "Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights," (General Comment No. 15 (2002) The right to water (arts. 11 and 12 of the International Covenant on Economic, Social and Cultural Rights). E/C.12/2002/11, 20 January 2003.).

[2] Ibid.

Defining the problem

Alaska Native tribes in the interior part of the state shifted from a nomadic to a village settlement lifestyle in the 1940s and 1950s. Among other things, this change in lifestyle posed the challenge of providing water. In 1959, the same year Alaska became a state,[3] Congress authorized the Public Health Service to work with Alaska Native communities in building water and sewer facilities.[4] See Figure 1.1 below to locate Alaska in a map.

Figure 1.1. State of Alaska, United States of America[5]

[3] The United States purchased the Alaska territory from the Russian Empire in 1867 but it was not until 1959 that Alaska became the 49th state in the Union.

[4] Natalie Eddy, "Alaska Update-Five Years Later: Honey Buckets Still Not Retired," *Small Flows Magazine* 2010, 17.

[5] Map courtesy of National Geographic Education. "Mapping: United States of America, Alaska." http://education.nationalgeographic.com/education/mapping/outline-map/?map=Alaska&ar_a=1 (accessed February 28, 2013).

However, despite the many decades of federal and state efforts to ensure that all villages have potable water and proper sanitation, there remain barriers to the provision and sustained operation of water and sewer systems in many Alaska Native villages. Some of these barriers include remoteness, limited local economies, challenging weather conditions and high infrastructure maintenance costs. Many of these barriers arise from the unique context in which Native Americans live in rural Alaska. In the paragraphs that follow I briefly elaborate on some of these challenges to further describe the problem under investigation in this thesis.

First, most small villages in the Interior of Alaska are not on the road system. Therefore, they are only accessible by air or waterways (depending on the season). Consequently, supplies must be shipped or flown into the villages, making the cost of living in rural Alaska up to 160 percent higher than in larger urban center cities, such as Anchorage, Fairbanks, and Juneau.[6]

Second, the cash economy is not always the predominant medium of exchange in Alaska Native villages.[7] Residents of these communities have traditionally led a subsistence lifestyle; activities such as whaling, hunting, fishing, and trapping have been performed to sustain community members. Mixed economies (exchange of cash as well as subsistence foods) now characterize villages, but lack of employment opportunities make cash a scarce resource. This is of particular concern as villages have increasingly become dependent on fossil fuels for daily activities. Affording the ever increasing price of this global commodity is a problem common in all villages.

Third, frigid temperatures make water supply and waste water system management difficult. It is a challenge to keep water and sewer lines from freezing. In northern Alaska,

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[6] Neal Fried, "The Cost of Living in Alaska: Energy prices a large part of 2011's rise in inflation," *Alaska Economic Trends Magazine*, July 2012, 12.
[7] Robert Wolfe and Robert Walker, "Subsistence economics in Alaska: productivity, geography, and development impacts," *Arctic Anthropology* 24, no. 2 (1987).

systems are typically above ground because of permafrost and the high cost associated with heating buried systems. In colder temperatures, conventional septic tank systems do not work because the ground is frozen year-round, and soils consist of large amounts of ice and silt. Warm waste water, 4 to 7 degrees Celsius (40 to 45 degrees Fahrenheit), melts the ice and can create large sinkholes in the ground.[8] Villages must instead rely on different water supply and waste disposal methods such as hauling water from a watering point in the community, using privies, and transporting waste water and solid waste in receptacles.

Also of interest is the fact that access to water and sewer utilities involves substantial electricity, transportation, labor, fuel, equipment utility management and personnel training costs to keep the systems running. Meeting these costs is particularly challenging for remote communities that primarily rely on a subsistence lifestyle with a limited cash economy. Lack of employment opportunities to earn cash in villages is a problem that in many cases leads to outmigration, reducing the customer base needed to sustain utilities. Adding to these challenges is a high turnover of utility clerks, managers, and water plant operators.

Additionally, a recent study found that in some cases water utilities are so prohibitively expensive that village residents avoid using these services to save money.[9] Laura Eichelberger argues that some families are being forced to charge their elderly relatives for sharing or hauling a couple buckets of water, as this constitutes an expense that they cannot bear (the cost of water itself and fuel money for hauling and transporting water). In this sense, expensive water utilities are not only a strain on the wallets of village residents but could also represent the undermining

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[8] Eddy, 19.
[9] Laura Eichelberger, "Living in utility scarcity: energy and water insecurity in Northwest Alaska," *American Journal of Public Health* 100, no. 6 (2010): 1016.

of Native social norms such as respect for Elders and sharing, the latter being a practice that is central to Alaska Native traditional economies.

Most importantly, another study indicates that problems in sustaining utilities could be associated with cross-cultural misunderstanding[10] resulting in a misfit of policies and a lack of other forms of local capacity to sustain these utilities, rather than simply a lack of economies of scale to afford them. Cross-cultural misunderstanding can be explained as miscommunication occurring between policy makers living in urban areas and the rural population they are attempting to serve, owing to differences in social norms and world views. Similarly, a report written by a rural sanitation coordinator argues that public officials act as the "gate keepers" to water and sewer access by operating with a set of solutions that may not be informed or culturally appropriate. The same report indicates that village residents and public officials experience a sense of hopelessness for having made all attempts possible to do their part to access and deliver safe water and sanitation, and failed.[11]

Research motivation

Barriers to the provision of these services are various and increasing, placing public health and capital investment at risk. There are two compelling arguments to conduct research that addresses this issue:

1. Promises have been made to pursue efforts to enhance public health through the provision of safe drinking water and sanitation. These promises are based in the trust relationship between the federal government and American Indian and Alaska Native (AI/AN) citizens.

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[10] Cindy Christian, *Building Drinking Water Capacity in Native Alaskan Villages* (Fairbanks: Drinking Water Program, State of Alaska, 2006-2007).
[11] Joe Sarcone, *A Measure and Process for Improving Human Excreta Disposal Practice in Rural Alaska Villages* (Anchorage: U.S. Environmental Protection Region 10, 2007-2008), 350, 355-357.

Between 1787 and 1871, the United States and Indian tribes signed hundreds of treaties transferring or sharing titles to lands in return for goods, money and other resources promised by the U.S. government.[12] Fiduciary trust obligations, as defined by federal law, include the protection of tribes' assets and provision of health, education and other basic human services to American Indian and Alaska Native tribes.[13]

2. Protecting the financial investments made with public funds (taxpayers' money) on this type of public works projects is essential. Ensuring returns is legally mandated by the statutes of various public funding agencies such as the Environmental Protection Agency, United States Department of Agriculture-Rural Development, and the Bureau of Indian Affairs. The argument for ensuring returns from investments in public infrastructure gains importance in times when government budgets are shrinking and pressures on the infrastructure are increasing, for instance in response to climate-driven changes in soil stability in the Sub-Arctic.

Recently, there has been a greater emphasis placed on finding financial and technological solutions to such infrastructure challenges in villages regardless of the fact that these responses are mainly provided by actors outside the villages. This may be problematic because once villages acquire water infrastructure through funding provided by the government, it is up to the users to find local resources to keep utilities running. Therefore, I posit a potential conflict between maintaining Alaska Native traditional skills related to self-reliance and developing increasing reliance on highly sophisticated utilities systems designed elsewhere. Such utilities systems are prone to breaking down and require skilled maintenance personnel to keep them

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[12] Although Alaska Natives did not sign a treaty, they also have a trust relationship with the federal government.

[13] David Case and David Voluck, "Native Entitlement to Services," in *Alaska Natives and American Laws*(Fairbanks: University of Alaska Press, 2002), 227-228; Midwest Alliance of Sovereign Tribes. "Trust Responsibility." http://www.m-a-s-t.org/TrustResponsibility.htm (accessed October 10, 2012).

running, not to mention continued high levels of funding, conditions which are difficult to meet consistently in villages.

Based on the aforementioned circumstances, I considered it to be worthwhile exploring the human dimensions of providing water and sanitation infrastructure in rural Alaska for the purpose of informing evidence-based and culturally appropriate solutions to ensuring the provisioning of healthy water for all.

Research question and aims

The United Nations in 2010 officially acknowledged that the human right to clean drinking water and sanitation was essential to the realization of all human rights. This historic event helped frame the goals of this study as well as the stages for data collection and analysis. Additionally, and to bring the promises made at the global scale closer to the local reality, I incorporated the concept of self-reliance into the design of this study because I considered it to be an appropriate and meaningful approach to addressing the research problem locally.

Self-reliance or self-sufficiency[14] is a social norm that has guided the lives of Alaska Natives for countless generations. Globalization has impacted villages; however, self-reliance remains a highly regarded value particularly for Athabascans in the Interior region of Alaska.

During discussions related to how the academic community could contribute to Native well-being through applied or action research, Athabascan leaders of Interior Alaska preferred to use the term self-reliance over western terms such as resilience and sustainability. They expressed that self-reliance, which is also a tribal value, was a more familiar term to them.[15] This spirit of

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[14] These terms are used interchangeably by Alaska Natives and participants in this study. I will do so as well according to the term the participant used in each given case.

[15] Craig Gerlach, University of Alaska Fairbanks Professor of Anthropology, interview by author, Fairbanks, February 18, 2011.

collaboration between University of Alaska researchers and Alaska Native villages gave birth to the Working Group on Rural Alaskan Self-Reliance in November 2010. The working group's mission is to promote self-reliance and well-being of Alaska Native communities, as defined by Alaska Native wisdom, through partnership between Native communities and the University of Alaska Fairbanks.[16] Consequently, I defined the overall research question guiding this study to be: *How does the public program for delivery of water and sewer service relate to the self-reliance of Alaska Native villages in the Interior region of Alaska?*

I operationalized the question into three research aims:

1. Explore concepts of healthy water, well-being and community self-reliance from the perspective of experts currently living in Alaska Native villages;
2. Explore the relationship between the current program for providing water and sanitation services and self-reliance in Alaska Native villages;
3. Build knowledge related to the strengths and limitations of the current public program for delivering water and sanitation services.

To gain understanding on these topics, I conducted semi-structured interviews with village residents from nine Interior villages who are knowledgeable about local water and sanitation issues and the process of obtaining and managing water systems. Informal discussions were also held with public officials, employees at tribal organizations, and other citizens

[16] This information has been retrieved from the Workshop Report for the first meeting of this working group. The workshop brought together Alaska Native leaders and University of Alaska (UAF) researchers who actively engaged in efforts to foster sustainability of Alaska. The meeting was organized by Native leader Larry Merculieff, Assistant Professor Jordan Lewis, and Professor Emeritus Terry Chapin. It was funded by UAF and facilitated by Larry Merculieff.

knowledgeable of water utility issues in Alaska Native villages. The responses received were coded and analyzed using a grounded theory approach to qualitative data analysis.[17]

Findings of this study elucidate limitations and opportunities to improving the current program for providing safe drinking water and sanitation in Alaska Native villages. This thesis shares new knowledge with Alaska Native tribal members and leaders, public officials, contractors, scientists from relevant disciplines and citizens locally and in the rest of the world who are interested in better understanding challenges and opportunities for enhancing access to safe water and sanitation in indigenous communities such as those located in rural Alaska.

Personal motivation

Interacting with people across cultures is a passion of mine. Likewise, helping people with different world views understand each other across language barriers is in my personal experience a meaningful and rewarding assignment. Therefore, I went to college to receive an educational background in linguistics and cross-cultural studies. I graduated as a professional interpreter and translator. After a few years working on German-led sustainable development projects with rural communities in Peru, I decided to pursue a masters' degree with a focus on environmental policy. I did so to incorporate my lifelong interest in environmental issues in my career path.

For my masters' thesis research I wanted to find a meaningful and motivating research topic in the intersection between addressing an environmental issue related to a critical (natural) resource and the interaction among people of differing cultures. Therefore, when I started looking into water issues in villages, the observation that there were differing world views at play

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[17] Anselm Strauss and Juliet Corbin, *Basics of qualitative research: Grounded theory procedures and techniques*, 2nd ed. (Newbury Park: Sage Publications, 1990).

resonated with me; a key issue in achieving sustainable development lies in successful interactions between urban policy makers or service providers and service users living in a rural, remote context.

During my initial discussions with tribal officials and water experts, I was rather overwhelmed by their stark concern about the decreasing funds for infrastructure needs so that the topic of self-reliance seemed distant but perhaps important. Thanks to the encouragement of my award-winning advisors I persevered on following the Native leaders' appeal for research projects addressing community self-reliance.

Finally, I was born and raised in a developing country with a great number of rural remote communities. However, I always lived in the capital city. Lima is Peru's largest urban center with a population approaching nine million. In conducting background research for this topic, I found myself once again *learning* to understand the other side: perspectives of rural residents. I decided to carry out this study to give a voice to rural perspectives. I was also motivated by the suspicion that researching the problem under study would constitute a personal learning experience rather than simply a career goal. I plan on applying the lessons learned in working toward culturally appropriate sustainable development in Alaska Native villages and other rural communities throughout the world.

Structure of the report

Chapter 1 identifies the area of research and the problem under investigation as well as my motivations and objectives for conducting this study.

Chapter 2 provides background information, introducing the readers to village life in the Interior region of Alaska, the types of water infrastructure available, and approaches to service

delivery that government agencies have employed. It also synthesizes an academic literature review through discussions with experts focusing on financial and, more importantly, non-financial challenges to a sustained access to water and sanitation in villages. The chapter concludes with an overview of the procedures involved whenever villages seek to access public funds for water and sewer projects. In this last piece, actors and sets of rules interacting across different jurisdictions or scales of government (i.e., multilevel or cross-scale governance) play a particularly important role.

Chapter 3 describes the methodology I used to address the research aims of this study. I define my role as a researcher, elaborate on the study design, and present the methods I employed for gathering and analyzing primary data provided by key representatives of nine Native villages located in the Interior region of Alaska.

Chapter 4 presents the findings from my analysis, organized in three parts. Each part addresses one of the three research aims stated in the introduction chapter of this thesis. The findings for each aim, collectively, respond to the overall research question guiding this study. The chapter ends with a discussion on limitations of this thesis research.

Chapter 5 summarizes the findings from the original research, my analysis and conclusions. The chapter ends with a section on policy recommendations and suggestions for further research.

2. BACKGROUND, CONTEXT, AND REVIEW OF LITERATURE

> *"We can just live off the land and the water is so clean that we can just drink it. We're one of the very few people in this world that [would make it] if all the stores closed."*
>
> —Water plant operator (63 years old)
> for community with 159 residents

The objective of this chapter is to provide an understanding of the geographic, sociocultural, and institutional context underlying water and sanitation services in Alaska Native villages as well as to contextualize this research within the literature published on related topics.

Village life in the Interior region of the State of Alaska, United States

Alaska Native people may belong to one or more of eleven distinct cultures, speaking eleven different languages and many more dialects.[1] To tell the stories of such a diverse population, the Alaska Native Heritage Center has identified five cultural groupings[2] which draw upon cultural similarities or geographic proximity. One of these groups is the Athabascan people.

Athabascans have traditionally lived in the Interior region of Alaska. Technically this region is bounded by the watersheds of the Brooks Range to the north and the Alaska Range to the south.[3] This area features the highest mountain peak in the United States, Mount McKinley or Denali (Koyukon Athabascan for "The High One", Dghelaayce'e in Ahtna) located in the Alaska Range. This region also features the Wrangell Mountains and the Ray Mountains. More

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[1] Alaska Native Heritage Center. "Athabascan Cultures of Alaska." http://www.alaskanative.net/en/main-nav/education-and-programs/cultures-of-alaska/athabascan/ (accessed October 8, 2012).
[2] These are the following: Athabascan, the Unangax and Alutiiq (Sugpiaq), the Yup'ik and Cup'ik, the Inupiaq and St. Lawrence Island Yupik, and the Eyak, Tlingit, Haida and Tsimshian
[3] Alaska Climate Research Center. "The Interior: First Order Stations." http://climate.gi.alaska.edu/stations/Interior/index.html (accessed October 10, 2012).

specifically, Athabascans have primarily roamed along five major river ways: the Yukon, Tanana, Susitna, and the upper regions of the Copper and Kuskokwim river drainages. Before significant Euro-American occupation of Alaska, Athabascans migrated seasonally, traveling in small groups to fish, hunt and trap to maintain a traditional subsistence lifestyle.

Athabascans call themselves "Dena," or "the people". Important resources in the Athabascan culture are the moose, caribou, waterfowl and game birds, salmon, freshwater fish, and birch trees. These resources have traditionally provided food, clothing, and shelter. Birch trees and their bark were essential to the traditional lifestyle as they were used for making canoes, containers, and baskets. In ancient times, Athabascans made tools from stone, antlers, wood, and bone. Today, Athabascans continue to engage in fishing as well as hunting for moose, caribou, mountain goats, sheep, other mammals, and birds.

The boundaries of the region Athabascans occupy in Alaska mirror those for the Doyon and Tanana Chiefs Conference region. Doyon Limited is the regional Native corporation for Interior Alaska (formed pursuant to the Alaska Native Claims Settlement Act[4]) and the Tanana Chiefs Conference is the non-profit tribal consortium providing health and social services to Interior Alaska tribal members.

[4] United States Congress, "Alaska Native Claims Settlement Act," (1971).

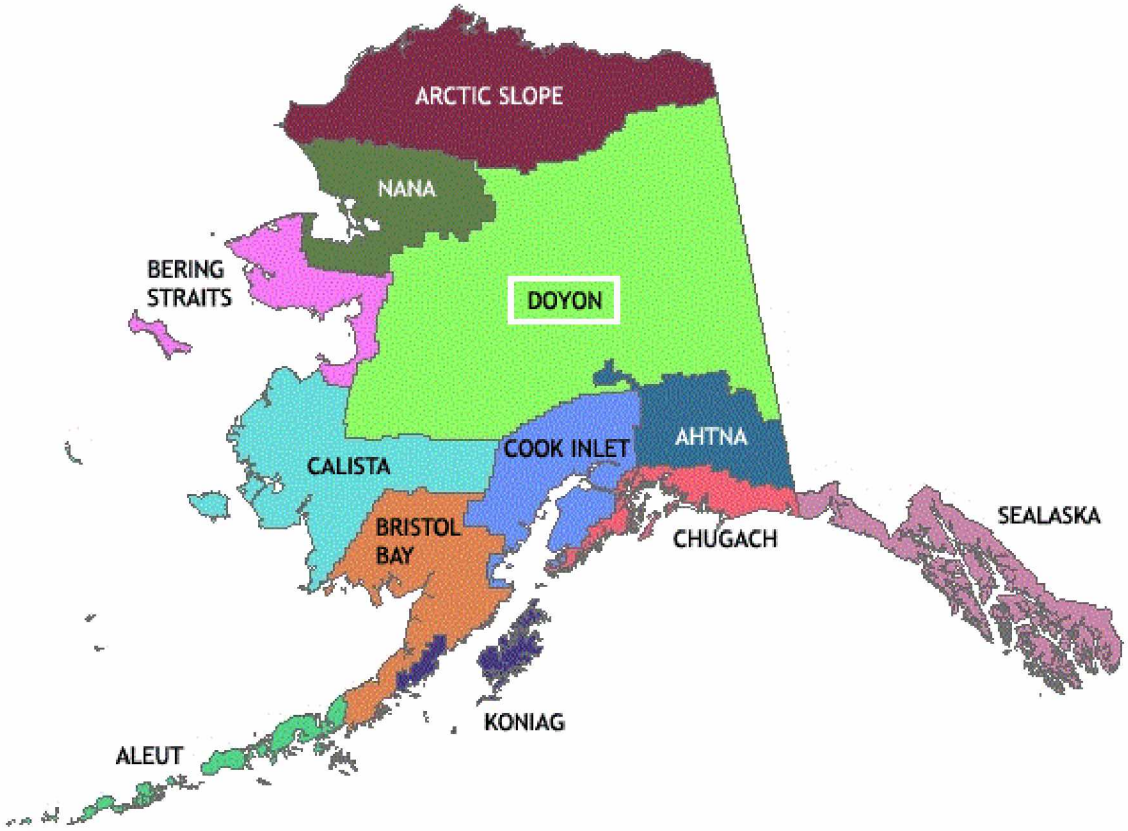

Figure 2.1. Map highlighting coverage of the Doyon Native Corporation which corresponds to the area represented by the Tanana Chiefs Conference in the Interior region of Alaska[5]

Population

There are forty-two communities within the Interior.[6] They are located throughout an area only slightly smaller than the state of Texas (268,581 sq. mi. or 696,241 km^2). Only eight of these communities are located on the road system. The rest are only accessible by air or by snow machine during winter and by boat or barge when the rivers are no longer frozen in the summer.

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[5] Adapted from First Alaskans Institute. "Population by ANCSA Region." http://www.firstalaskans.org/index.cfm?section=Census-Information-Center&page=Regional-Fact-Sheets (accessed February 28, 2013).

[6] Alda Norris. "Interior Alaska Village Food Systems." Cooperative Extension Service. http://www.uaf.edu/ces/nrcd/village-food-systems (accessed October 10, 2012).

Following the Anchorage Matanuska-Susitna[7] region, Interior Alaska has the second largest regional population with 115,114 residents accounting for approximately 15.7 percent of the state's total population of 732, 298.[8] Most of the Interior population is concentrated in the Fairbanks North Star Borough. However, the percentage of Alaska Natives in the Interior region varies widely between urban and rural areas. For example, in the mostly roadless Yukon-Koyukuk Census Area, Alaska Natives comprise roughly 76.4 percent of the total population in contrast to 15 percent in the Southeast Fairbanks Census Area,[9] which includes six tribes of the Upper Tanana and a few small towns located along the Alaska Highway. The lowest percentages of Alaska Natives reside in urban settings with 10.9 percent in the Fairbanks North Star Borough and 6.3 percent in the Denali Borough.[10]

Unlike other areas in Alaska, there are no large, predominantly Native regional centers in Interior Alaska. There are only two subregional hubs: Galena and Ft. Yukon with 484 and 586 total residents each.[11] Smaller satellite villages range in population from about 40 to 350 residents each. The small sizes and dispersed locations of the villages in this region make the provision of water utilities especially difficult, because of the small customer base to sustain the costs of running a utility. Furthermore, the populations of many rural communities in the Interior, as in the rest of the state, have declined since the 2000 census. State demographers project that rural

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[7] The Matanuska-Susitna Valley is located north of Anchorage in Southcentral Alaska.
[8] Alaska Department of Labor and Workforce Development. Research & Analysis Section. "Population By Borough/Census Area and Economic Region." http://www.labor.state.ak.us/research/pop/popest.htm (accessed October 10, 2012).
[9] ------. "Alaska Census Data: 2010 Census Demographic Profiles." http://hve.laborstats.alaska.gov/cen/dparea.cfm (accessed March 28, 2013).
[10] Ibid.
[11] Community and Economic Development State of Alaska: Department of Commerce. "Community Details: Current Population." http://commerce.alaska.gov/dca/apps/DCRAExternal/community (accessed February 24, 2013).

communities will continue to lose population due to net out-migration.[12] Out-migration not only reduces the customer base needed to share the costs of these services and the benefits attained through service delivery, it also represents loss of gradually acquired local capacity for administering and operating water and sanitation systems.

Economy

Interior villages are considered remote and rural for both their geographic isolation and the absence of urban features such as hospitals, retail businesses, fire and police departments, and diversified employment. All the Interior villages, excluding Nenana, are more than one hundred miles from Fairbanks, the region's sole urban area.[13]

The term subsistence describes traditional activities for collecting and consuming food (hunting, fishing and gathering). Sharing is at the core of Athabascan subsistence living. All hunters are part of a kin-based network in which they are expected to follow traditional customs for sharing in the community.[14] Exchanges do not occur simply within the village but also with other communities. For example, Interior Natives in the lower Yukon area may send fish strips to people upriver or receive muktuk[15] or seal oil from residents of coastal villages. Sharing or exchanging can be equated with financial transactions in the western world with the exception that goods or services are traded without a form of monetary currency.[16]

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[12] Jana Peirce et al., *The Economic Impact of Alaska Native Organizations on Interior Alaska* (Fairbanks: Information Insights, Inc., 2008), 24. Net migration rate is the difference of immigrants and emigrants of an area in a period of time. A positive value represents more people entering the community than leaving it, while a negative value means more people leaving than entering it.
[13] Norris.
[14] Alaska Native Heritage Center.
[15] Whale blubber and skin.
[16] However, it could be argued that in this form of economy fresh, wild foods are the currency.

Although people may contribute gasoline or ammunition to hunters, lend a fish net, or help cut meat or fish, few trades involve cash.[17] Fish can be an exception as jarred fish or fish strips are often sold for cash. This distinctively communal bartering system differs from the monetary market system common in other rural or urban areas of the United States.

Even with the importance of sharing, Interior village economies today adhere to a mixture of subsistence, market and transfer economies. This evolution has taken place over a century or more. Modern mixed village economies have been built on a combination of traditional and contemporary practices. The predominance of one sector over the other varies across communities but most village residents rely to some extent on all three economic modes.[18] The coexistence of different types of trade or economic exchange reflects the values and realities of modern village life as residents navigate through traditional and western norms while undergoing rapid cultural change.

Alaska Native tribal governments

Tribal governments in Alaska have various names, often depending on the legal instruments or norms under which they were founded. These include village council, Indian Reorganization Act (IRA) council, traditional council, tribal council and tribal government. Most of the forty-two Alaska Native tribes and communities in the Interior region are represented by a village council for the purposes of tribal self-governance. The vast majority of Interior villages have no municipal or civic government (i.e. town government chartered by the state). In ten villages, councils provide local government services, which may include electric and water

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[17] Customary trade (including country foods in exchange for cash) is allowable up to a certain amount set by policy.

[18] Lee Huskey, *The Economy of Village Alaska*, ed. Institute of Social and Economic Research (Anchorage: University of Alaska Anchorage, 1992), 8.

utilities, washeteria[19] operations, firefighting, emergency preparedness, housing and social services, health and nutrition programs, airport maintenance and environmental cleanup.

Alaska Native tribal governments and other Native American tribes are essentially semi-sovereign "nations" within the territory of the United States.[20] According to federal Indian law, tribes are dependent on the federal transfers for many of their resources, reflecting the federal trust responsibility toward indigenous peoples in the U.S. The trust relationship requires the federal government to protect tribal nations and individuals within those nations. The Indian Self-Determination and Education Assistance Act of 1975 was enacted to further the goals of Indian self-determination and national sovereignty.

Indian self-determination is defined as a policy that permits an orderly transition from the federal domination of programs for, and services to, American Indians to effective and meaningful participation by the Indian people in the planning, conduct, and administration of those programs and services. According to this policy, the United States is "committed to supporting and assisting Indian tribes in the development of strong and stable tribal governments, capable of administering quality programs and developing the economies of their respective communities."[21]

The Indian Self-Determination Act allows tribes to enter into contracts with the U.S. government to administer programs and services traditionally provided by the federal government. Federally recognized tribes receive funding to support tribal self-governance from the Bureau of Indian Affairs (BIA) and funding for health services from the Indian Health Service

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[19] Also known as washhouses in some villages. These facilities provide sinks, flush toilets, showers, washers and dryers, as well as drinking water for hauling.
[20] Cherokee Nation v. Georgia, 30 U.S. 1 (1831).
[21] Legal Information Institute. "25 USC § 450a - Congressional declaration of policy." Cornell University Law School. http://www.law.cornell.edu/uscode/text/25/450a (accessed February 18, 2013).

(IHS). Village councils may receive self-governance funds directly or, more often, through the Tanana Chiefs Conference (TCC) or the Council of Athabascan Tribal Governments (CATG),[22] which have legal authority to obtain grants from the BIA and the IHS and pass funding to tribes. They may also assume management responsibility for many federally funded programs within villages. One example of the latter situation is the management of funds for water and sanitation projects in some villages. Village councils also receive direct federal and state grants to operate specific projects or programs in their villages. Some village councils have started for-profit business ventures to provide income and create employment for village residents. For example, the Stevens Village IRA Council operates the village utility in Stevens Village and a bison farm in Delta Junction.[23]

Geography and climate

The Interior region of Alaska is considered one of the best places on earth to view the Aurora Borealis. The Aurora, also known as the northern lights, can often be seen dancing in the sky on clear winter nights. Inuit ancestors believed that the northern lights were the torches of spirits guiding souls to a land of happiness and plenty.[24] Turn of the century gold rush prospectors believed the colors were rising from the Mother Lode, principal vein or zone of veins of gold or silver ore.[25]

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[22] CATG specifically supports tribal self-governance of villages in the Yukon Flats subregion: Circle, Rampart, Venetie, Birch Creek, Beaver, Fort Yukon (Gwich'yaa Zhee), Chalkytsik, Arctic Village, and Stevens Village. Information retrieved from CATG's website: Council of Athabascan Tribal Governments. "Board of CATG Chiefs." http://www.catg.org/our-story/board-of-chiefs/ (accessed March 7, 2013).
[23] Peirce et al., 18.
[24] United Cherokee Ani-Yun-Wiya Nation. "Legend Categories for North America & Arctic Area: Inuit - Auroras." http://www.ucan-online.org/legend.asp?legend=5592&category=1 (accessed March 17, 2013).
[25] Fairbanks Convention & Visitors Bureau. "Northern Lights Shine On Winter Adventure in Fairbanks." http://www.explorefairbanks.com/articles/detail/36/northern-lights-shine-on-winter-adventure-in-fairbanks (accessed February 28, 2013).

Discussing the particular weather conditions in Alaska sets the stage for understanding challenges to developing water utilities in all Native villages. As in all subarctic regions, the months from May to July have no night, only twilight during the night hours. There is little daylight between November and January. The Interior region receives an average of 21 hours of summer daylight between May 10 and August 2 and an average of less than four hours of daylight between November 18 and January 24 in the winter.[26] These exotic features of life in the far north complement a more stark reality that presents formidable challenges to providing infrastructure such as running water and sewage systems that people who live elsewhere in the industrialized world take for granted.

Extremes characterize the climate in Interior Alaska, as it has recorded the warmest summers in the state, as well as the lowest winter temperatures. Mean annual temperatures average slightly below freezing with annual temperatures ranging from -40° to 90°F (-40° to 32°C). Both the highest and lowest temperature records for the state were set in the Interior, with 100°F (38°C) in Fort Yukon and -80°F (-64°C) in Prospect Creek.[27]

Temperatures within a given winter are highly variable; extended cold snaps of 40 degrees below zero (°F or °C) can be followed by unseasonable warmth with temperatures above freezing due to (warm) "Chinook" wind effects. Summers can be warm and dry for extended periods creating ideal forest fire weather conditions. Weak thunderstorms produce mostly dry lightning, sparking wildfires that are sometimes left to burn themselves out as they are often far from populated areas.

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[26] The American Local History Network. "The Interior Region of Alaska." http://www.usgennet.org/usa/ak/state/region-interior.html (accessed March 17, 2013).
[27] Western Regional Climate Center. "Climate of Alaska: Temperature." http://www.wrcc.dri.edu/narratives/alaska/ (accessed February 25, 2013).

The Interior region of Alaska is largely characterized by discontinuous permafrost,[28] which is easily disturbed by fire or human activity. The closer to the Arctic Circle the more continuous the permafrost layer becomes. In some villages water sources become seasonally unavailable either by drying in the summer or freezing in the winter. This requires the storage of large quantities of water, with heat provided during the winter to avoid freezing. These circumstances (extreme temperatures and the presence of permafrost) make the design and operation of water and sewer systems more challenging and expensive than in other regions.

Water provision in rural Alaska: Types of water and sewer systems

The "Honey Bucket" has historically been the principal means for collecting waste water in Interior villages. The term derives from an old practice of affixing a toilet seat to a five-gallon plastic bucket previously used as a container for honey. Individuals can dispose their waste by hauling it to the collection point (self-haul) or by registering for community pickup or hauling service. Construction of water and sanitation systems in rural Alaska did not begin until the territory reached statehood status and Congress authorized the Public Health Service to work with Alaska Native communities in building these systems. In 1954, Public Law 83-568 established the U.S. Public Health Service Indian Health Program (later named the Indian Health Service) as responsible for improving the health of indigenous communities in the United States.[29]

In the 1970s, federal funds supported construction of sewage disposal bunkers and fenced sewage lagoons in Alaska. Wells and watering points were established to provide centrally

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[28] A thick sub-surface layer of soil, sediment, or rock that remains frozen throughout the year.
[29] Thomas Hennessy et al., "The Relationship Between In-Home Water Service and the Risk of Respiratory Tract, Skin, and Gastrointestinal Tract Infections Among Rural Alaska Natives," *American Journal of Public Health* 98, no. 11 (2008): 2077.

located water sources for clean drinking water. "Washeterias" or washhouses were built to provide sinks, flush toilets, showers, washers and dryers, as well as drinking water for hauling.[30]

In the 1980s, the "Hopper System" was introduced and began offering "Open Haul," a new and more sanitary means of transporting waste water. Hoppers or bins were placed at central locations of villages, making it easier for residents to dispose the content of honey buckets. Bins were transported to a sewage lagoon, often as frozen cubes during winter. Construction of waste water and water systems connected to homes began in the late 1980s.

In the early 1990s, a system called "Flush and Haul" was developed, whereby a tanker vehicle delivered water to homes. The water is usually stored in a big tank outside the house. A second tank holds waste water that is flushed down the toilet or drained from the sink. A community vehicle vacuums the waste water from these tanks and takes it to the community waste water lagoon system. This system also exists in urban parts of the state, for the most part outside of city limits. This type of infrastructure is helpful when permafrost does not allow easy access to underground water or where high levels of toxins are present in local waters (e.g., concentration of arsenic that varies throughout the Fairbanks area).

In the mid 1990s Governor Tony Knowles announced an initiative to "put the honey bucket, [where it belongs,] in the museum"[31] implying the goal of providing every village with modern water utilities. However, by 2008, the percent of Alaska Native homes with water and

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[30] Eddy, 17.

[31] Ralph Thomas and Marilee Enge, "Knowles unveils agenda state speech tries to meld factions," *Anchorage Daily News*, January 18, 1995; Lt. Gov. Fran Ulmer, "Alaska Native Economic Summit Opening Remarks," (February 26, 1995) in Kawerak Inc. & Bering Strait Development Council, *Bering Strait Comprehensive Economic Development Plan 2009-2013* (2009).

sewer service[32] varied from 58 percent to 98 percent across regions, with 60 percent of village homes in the Interior being served.[33]

As of 2012, there were about 240 remote, off road, communities in Alaska, 214 of which were served by a variety of water and sewer systems; a remaining 26 were not served by any kind of indoor system (Figure 2.2).

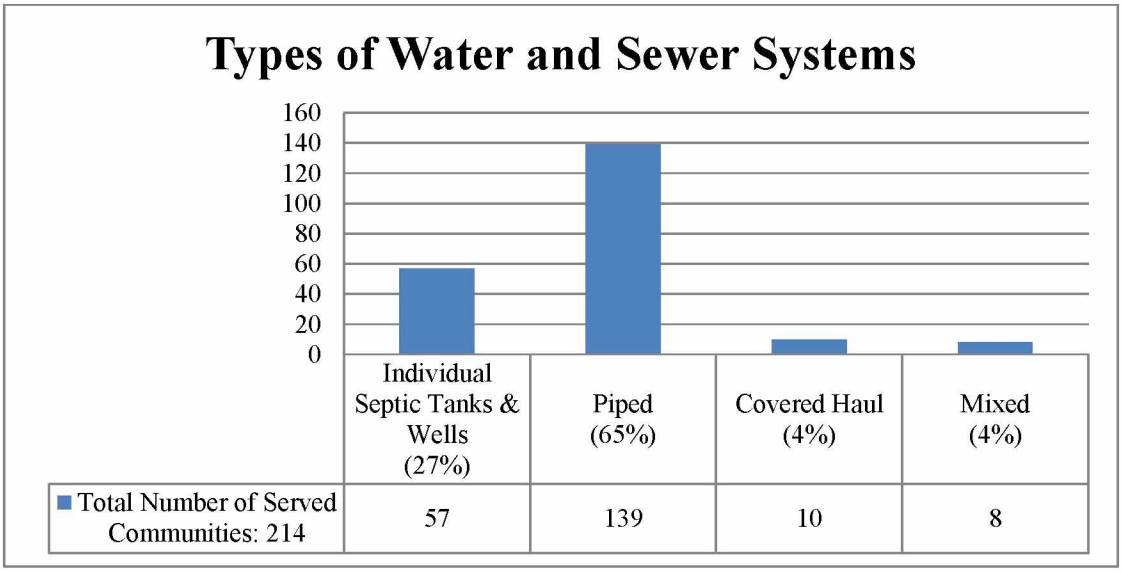

Figure 2.2. Types of water and sewer systems[34] [35]

According to the Alaska Department of Environmental Conservation (ADEC), currently, individual septic tanks and wells are the optimal system for rural areas. Septic tanks and wells are always recommended where soil and water conditions allow. Piped systems are the second ranked option as these imply higher capital and operating costs than septic systems and wells. Covered

[32] Water and sewer service is defined by the Alaska Native Tribal Health Consortium as a housing unit with flush toilets and pressurized water.
[33] Kyla Hagan and Ellen Provost, *Alaska Native Health Status Report* (Anchorage: Alaska Native Tribal Health Consortium, 2009), 88.
[34] Data set includes served communities and communities with system construction nearing completion. A served community is defined as one in which 55 percent or more of homes are served by a piped or covered haul system.
[35] Information was provided by Bill Griffith, Facility Program Manager at the Alaska Department of Environmental Conservation, in handouts he uses for public presentations.

haul is the third-ranked option, the recommended alternative if individual septic and wells and pipes are not feasible, but these often have higher operating costs than piped systems. Least preferred are the mixed systems which are recommended when utilization of a single system is not feasible or practical.[36]

Old versus new approaches

The Alaska Department of Environmental Conservation is the governmental agency responsible for funding and regulating water and sewer infrastructure through the state. The initial approach that ADEC employed since before 1970 emphasized the use of "centralized" or piped water systems to bring 100 percent of water treatment to safe drinking water standards.

As laid out in Figure 2.3, this centralized approach implies the storage of large quantities of water that require complex and costly heat addition during the winter to avoid freezing. Because natural local water sources are only available seasonally in some villages, large water tanks are sometimes necessary in rural Alaska. After being treated in the central water plant, water is distributed to individual homes via pipes or a haul vehicle with heat for circulating water systems. Household sewage is collected for disposal at the sewage lagoon, which also often times requires some type of heat addition.

[36] Ibid.

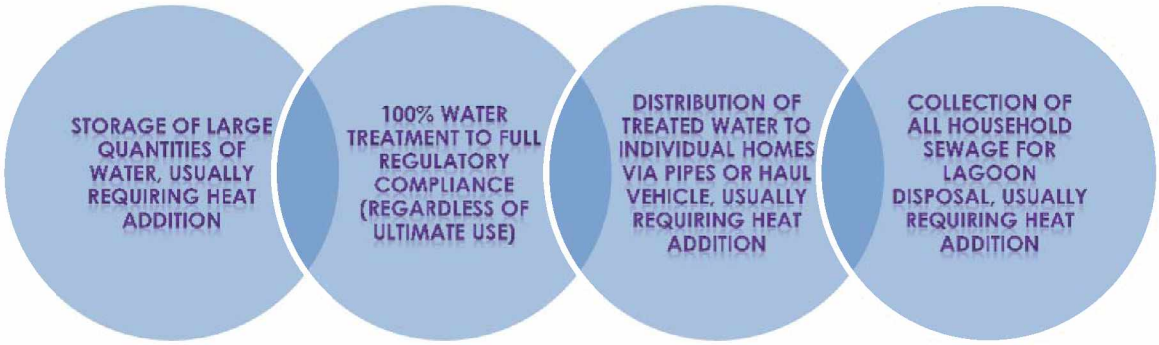

Figure 2.3. Agency's "centralized" approach since 1970[37]

Bill Griffith, of the Facility Programs office at the Alaska Department of Environmental Conservation (ADEC), reported that, with this approach, the agency has made much progress, as thirty years ago fewer than 25 percent of rural Alaska households had running water and sewer. In 1996 this percentage rose to just over 50 percent and today it is at about 75 percent. However, Griffith added that "we're actually at over 90 percent because if you count regional hubs like Bethel, Kotzebue, Dillingham and other big population centers where a lot of people live, you can see that all their residents are served by the service. Now, if you set those aside, we're at about 75 percent."[38]

Considering that centralized systems are financially and technologically demanding, Griffith shared the agency's concern regarding the suitability and practicality of a centralized systems approach in rural Alaska. He explained that the agency's new approach is to prioritize water projects based on the extent of health benefits they can deliver (disregarding the type of infrastructure required) in addition to taking into account the community's ability to run the project.

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[37] Bill Griffith, "Overview of Funding and Needs for Rural Alaska Water and Sewer Improvements," in *USARC Workshop: 2nd Annual Water and Sanitation Innovations for the Arctic* (Anchorage: United States Arctic Research Commission and the Centers for Disease Control and Prevention, 2012).
[38] Bill Griffith, interview by author, Fairbanks, February 23, 2012.

Griffith also related how stringent federal regulations or industry lobbying pressure in Congress can challenge rather than strengthen the work of the state agency by its inflexibility or by being private sector driven (making purely economic decisions):

> In other countries a rural community might have a place in town where residents collect their drinking water, but water for other uses is delivered to homes at a lesser quality than that of drinking water with the understanding that it is permissible to have a little higher mineral content in water used for bathing, flushing toilets or washing clothes. However, such an option is not available in the United States. The Federal Safe Drinking Water Act does not allow anything but full regulatory compliance for a community water system and there is no way to go around it unless the U.S. Congress takes action. At the same time, there is industry pressure in Congress to make regulations more stringent rather than less stringent. There are lobbyists working for businesses that are dependent on new regulations that are stricter than current regulations because they have developed new technology that they want to sell.

These examples illustrate how the dynamics of service provisioning can be affected by the interplay between regulations and institutions at multiple levels and scales of governance as in Figure 2.4 below. Recognition of these dynamics sheds light on challenges addressed in this research project as there are different jurisdictions (layers of governance) and knowledge systems (federal, state, tribal and local) constantly interacting with each other and affecting the provision of water and sewer service at the village level.

Figure 2.4 illustrates various scales or levels of time, space, institutions, etc. that can affect sustainability of human-environment interactions.

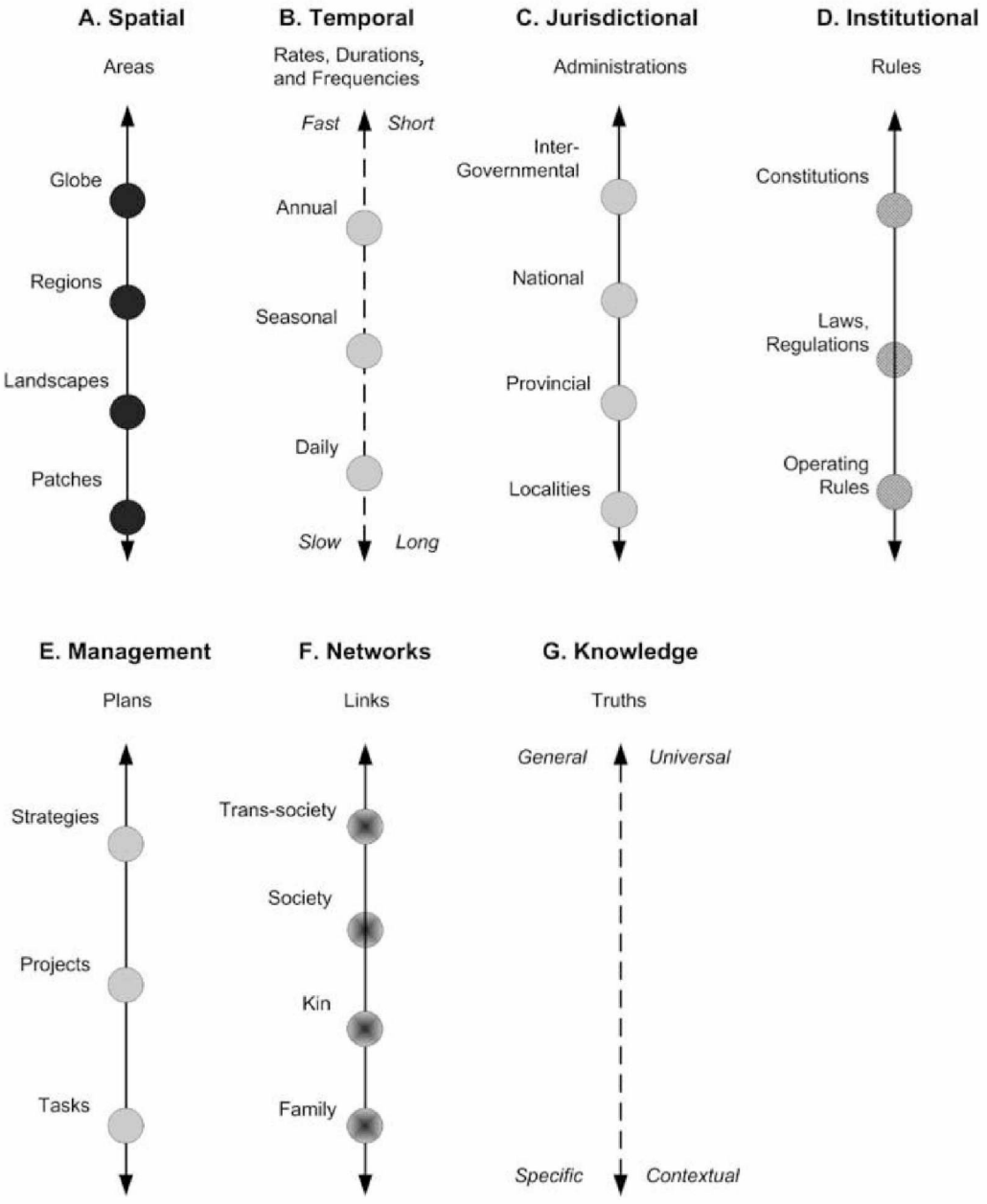

Figure 2.4. Schematic illustrations of how scale relates to multiple phenomena[39]

[39] David Cash et al., "Scale and Cross-Scale Dynamics: Governance and Information in a Multilevel World," *Ecology and Society* 11, no. 2 (2006). http://www.ecologyandsociety.org/vol11/iss2/art8/ (accessed February 22, 2011).

Stringent federal regulations and industry pressure in Congress are not the only challenges that state agencies face. As we will see in the following section, decreasing funds including a lack of financial assistance for the operation and maintenance of rural water systems, political constraints specific to Alaska, as well as other less explored non-financial issues are additional barriers to the sustained access to safe drinking water and sanitation in rural[40] Alaska Native villages.

Current challenges to the delivery of water and sewer service in Alaska Native villages

Despite the many decades of federal and state efforts to ensure that all Alaska villages have potable water, numerous barriers to the provision and sustained operation of safe water and sewer systems in villages persist. These ongoing obstacles include geography and climate, short construction seasons, exorbitant transportation costs,[41] lack of funding for continuing maintenance, and insufficient local involvement or skilled labor to operate and maintain the systems.

A white paper published in 2008 by Information Insights, a Fairbanks consulting firm, offered a fairly accurate representation of such collective barriers through Figure 2.5 below, and suggested a few options for funding operation and maintenance (O & M) of small water systems to enhance the sustainability of service delivery.

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[40] While all rural communities have similar issues with acquiring and maintaining systems, villages with a majority Alaska Native population are also governed under more complex institutional settings, including tribal governments, fiduciary duties of the federal government, etc.

[41] This is particularly the case in remote villages that can only be accessed by air. Costs for flying parts or infrastructure supplies into a village can become an overwhelming percentage of a project's budget.

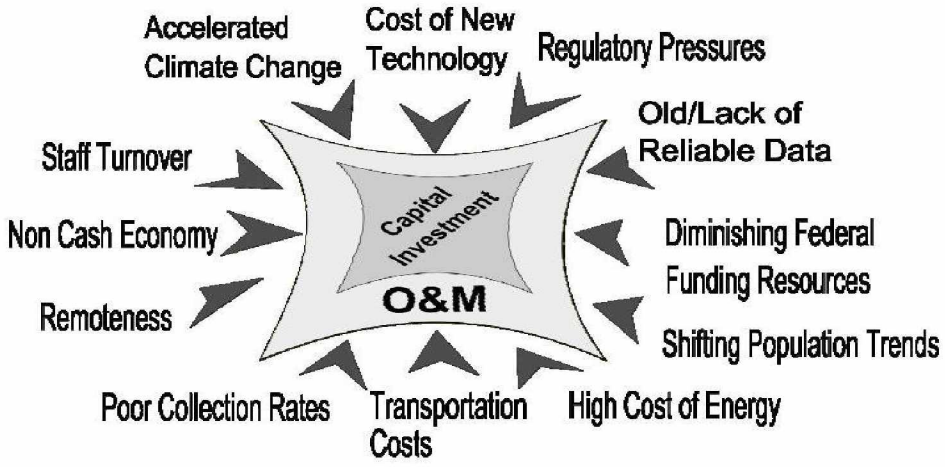

Figure 2.5. Illustration of external and internal pressures affecting the ability of a community to maintain water and sewer systems[42]

This figure suggests that collectively, these barriers emphasize a need for more financial resources, or they illustrate lack thereof. According to agency officials, the Alaska Department of Environmental Conservation's greatest concern is the ever increasing critical needs in the face of ever decreasing available funds.

However, recent academic studies and discussions with experts suggest that problems in sustaining utilities could also be associated with challenges of a non-financial nature, for example, lack of recognition of the human factor and cross-cultural misunderstanding[43] revealing an oversight of the "human dimension" involved in service delivery. This lack of recognition results in a misfit of policies, technological mismatch, as well as insufficiently developed local capacity, rather than merely a lack of financial resources or economies of scale to afford utilities. Therefore, in addition to discussing issues of a financial nature, this section will provide an initial

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[42] Indra Arriaga and Cady Lister, *Sustaining Rural Water Systems: Exploring Options for Funding Operations and Maintenance of Small Water Systems.*, Prepared for the Rural Alaska Sanitation Coalition (Fairbanks: Information Insights Inc., 2008), 4.
[43] Christian, 13.

exploration of other challenges to service delivery. Subsequently, I will address in detail the number one concern of Alaskan officials: the widening gap between infrastructure needs and available funds.

Financial issues

Water and sewer projects began with a fairly low level of funding in the 1970s and remained at that level for many years until funding increased in the mid 1980s as Figure 2.6 shows below.

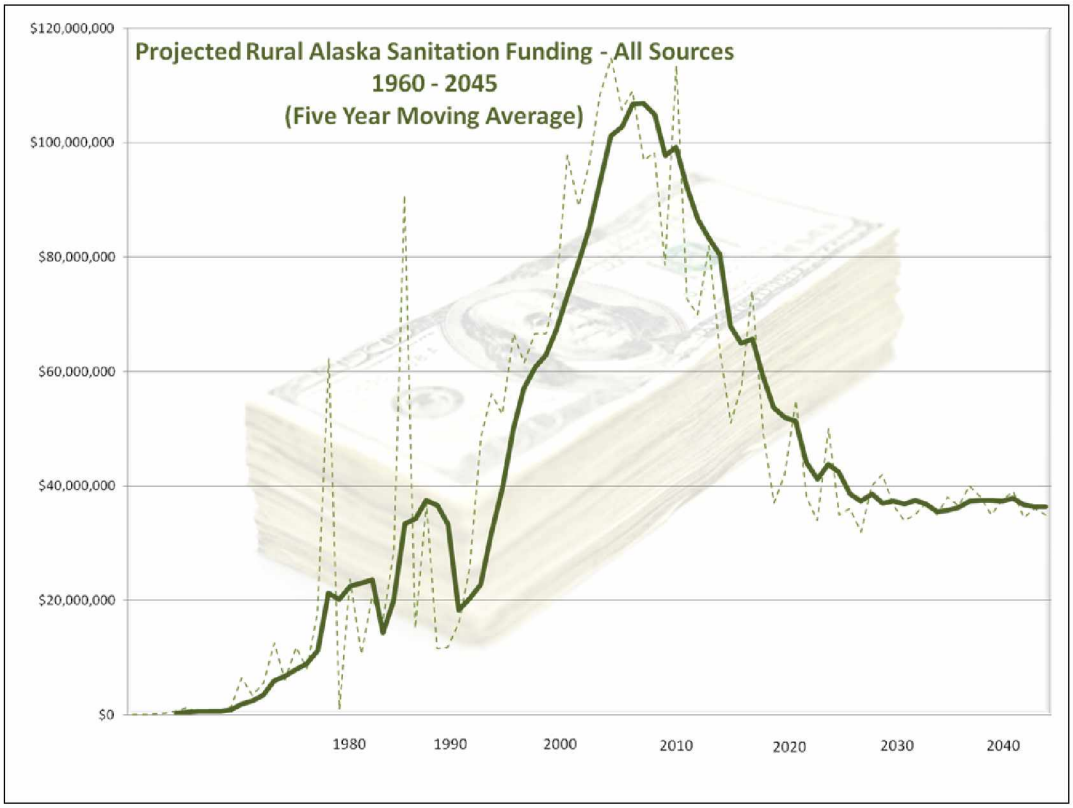

Figure 2.6. Predictions of future funding for water and sewer projects in Alaska[44]

[44] Bill Griffith, "Alaska Village Sanitation: Current Status and the Need for New Technology," in *USARC Workshop: Water and Sanitation Innovations for the Arctic* (Anchorage: United States Arctic Research Commission and the Centers for Disease Control and Prevention, 2011).

Another escalation in funding took place in the 1990s, peaking in 2004. Since then, funding has been on a downward trend, explaining the agency's current concern regarding the growing gap between needs and available funds (Figure 2.7), because it puts at risk ongoing projects (to deliver water and sanitation in villages) and the health improvements achieved in the last decades.

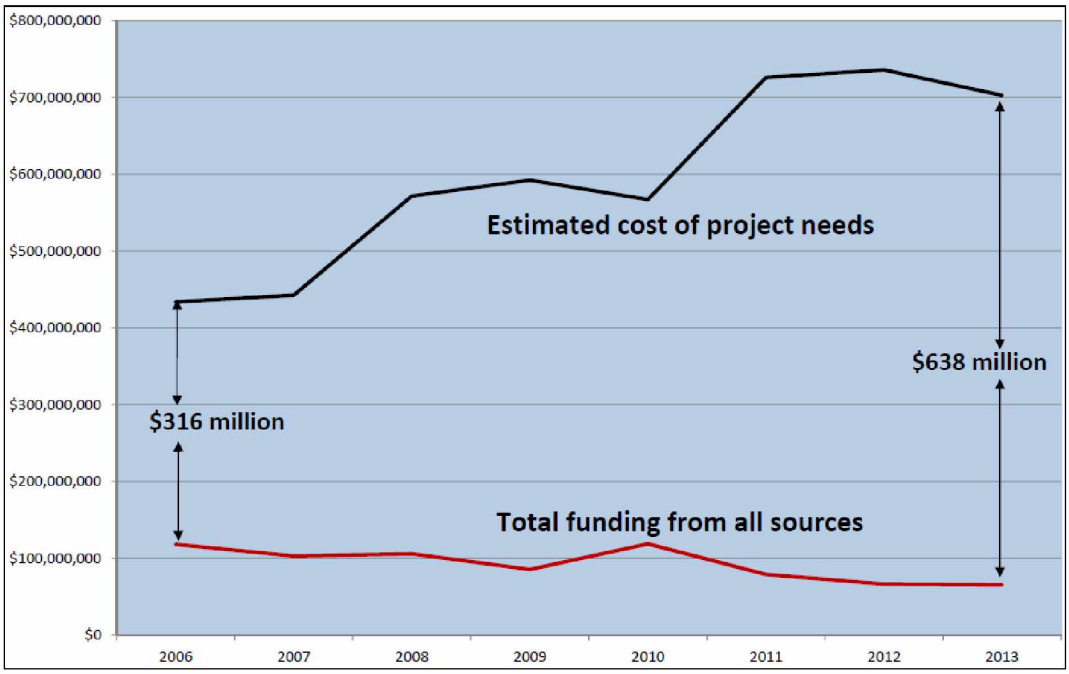

Figure 2.7. The growing gap between critical needs and available funding[45]

As shown in Figure 2.7 funding has decreased but the costs of addressing critical health related rural sanitation needs (such as homes without running water and flush toilets or inadequately treated drinking water) have increased over 60 percent since state fiscal year (SFY) 2006. This increase reflects a variety of factors including inflation, aging facilities, and more stringent regulations. The disparity between available funding and the cost of addressing critical

[45] Ibid.

health related needs was approximately $638 million in 2012, a more than 100 percent increase since SFY 2006. If funding remains stable, this gap will continue to grow sharply, warns the ADEC.

Funds have been decreasing primarily because the amount of support that flows through the state (nourished by federal funds) is a function of the ability of Alaska's Congressional delegation to garner allocations for Alaska. Dennis Wagner of the Region 10 Alaska Operations Office at the Environmental Protection Agency in Anchorage explained in an interview that the federal agencies, United States Department of Agriculture (USDA) and Environmental Protection Agency (EPA), request an allocation every year for water and waste water in Alaska, but in the past, Senator Ted Stevens[46] had the ability to take what the agencies proposed and increase, often double, such amount. Presently, these agencies continue to provide Alaska with support but Alaska's current delegation has not been as effective in eliciting additional funding as Senator Stevens was. In general, the ability of any senator or representative to draw special appropriations into his or her state is weaker than it was 10 years ago. "We are all aware of the fact that the country has a giant deficit now and there is a lot of pressure to do what we can to reduce the deficit and spend less money," explained ADEC Facility Program Manager Griffith in an interview.

As shown in Figure 2.8, the stream of tribal funds coming through IHS and EPA tribal programs (represented by the purple bars)[47] has been relatively stable. With the exception of the 2011 boost in funding as a result of the American Recovery and Reinvestment Act, this funding

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[46] U.S. Senator Ted Stevens of Alaska died in 2010. He had served as Alaska's senator for 40 years, from 1968 until January 2009.

[47] In case copies of this thesis have been reproduced in black and white this funding source is represented by the second solid bars from the top down for years 2004 – 2009 and 2011 – 2013. For year 2010, funds from this source are represented by the third solid bar from the top down. The solid bar at the top represents a one-time allocation of funds through the American Reconstruction and Recovery Act of 2009.

has not varied much. Unlike funds from the USDA and EPA which have seen a dramatic decline, tribal funds have for the most part remained consistent because they are formula driven nationally, and have nothing to do with our congressional delegation's political clout.

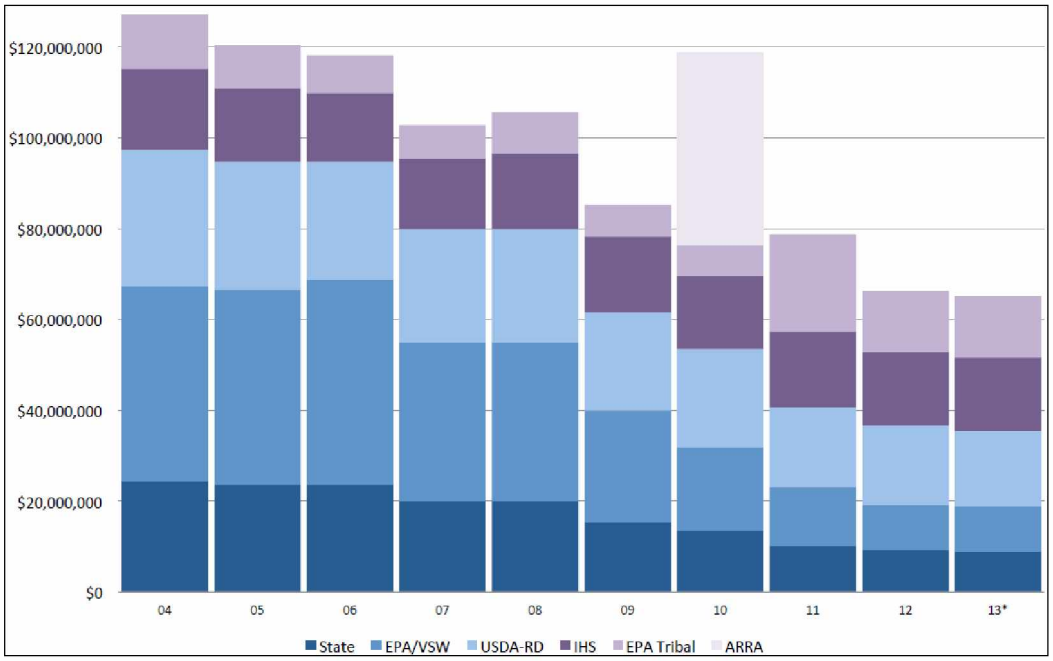

Figure 2.8. Project funding from all sources 2004 -2013[48]

More specifically, USDA and EPA funds are appropriations through the State of Alaska that require a 25 percent match originated in local funds. In other words, for every $3 that these two agencies invest in the program, the State of Alaska must provide $1 for a total of $4 invested in a project. Although the state could increase its local contribution to water and sewer projects to offset the decrease in federal funds "all the state of Alaska has done is provide the funding necessary to capture this federal funding but nothing more than that," as ADEC official Griffith noted.

[48] Bill Griffith, "New Approaches to Basic Water and Sewer Service," in *USARC Workshop: 3rd Annual Water and Sanitation Innovations for the Arctic* (Anchorage: United States Arctic Research Commission, the Centers for Disease Control and Prevention, and Alaska Native Tribal Health Consortium, 2013).

Current and future infrastructure needs for servicing all of rural Alaska

In over half a century, approximately $2 billion has been spent on water and sewer projects using the agency's "centralized" approach (providing community-wide system). As defined by ADEC, an unserved home is one which is not connected to an onsite or community piped or closed haul system; and an unserved community is one in which less that 55 percent of residences are connected to an onsite or community piped or closed haul system.

Figure 2.9 shows the status of water and sewer household service delivery in rural Alaska as of February 2012 with 6,089 homes yet to be served and 1,799, or about one third of these, located in already served communities. Almost two-thirds of the unserved homes (4,229) are located in unserved communities and the cost to address these is high because extensive, cost-prohibitive infrastructure would be required to serve these homes, even in villages where part of the community is already served. By contrast, delivering service to homes in already served communities is typically a matter of placing a service line from the home to the existing water infrastructure, which represents a lesser burden on technical and financial resources.

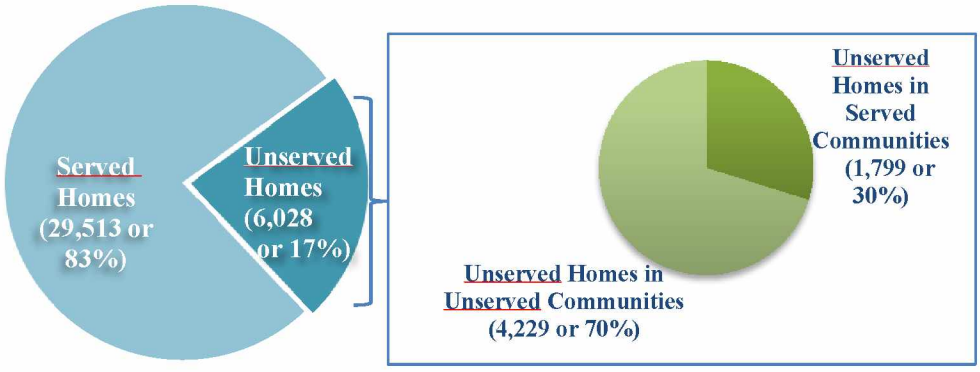

Figure 2.9. Distribution of unserved homes in served versus unserved communities [49]

[49] ------, "Overview of Funding and Needs for Rural Alaska Water and Sewer Improvements," 5.The data used for this figure is comprised of housing information for all communities that meet federal funding

Furthermore, as Figure 2.10 shows, homes not connected to existing infrastructure, and lacking funds for service make up about 47 percent of the 6,028 unserved homes, while "unserviceable"[50] homes represent about 36 percent of the total. These "unserviceable" homes have historically been considered as very difficult projects by the agency and were prioritized last, owing to the cost-prohibitive centralized approach.

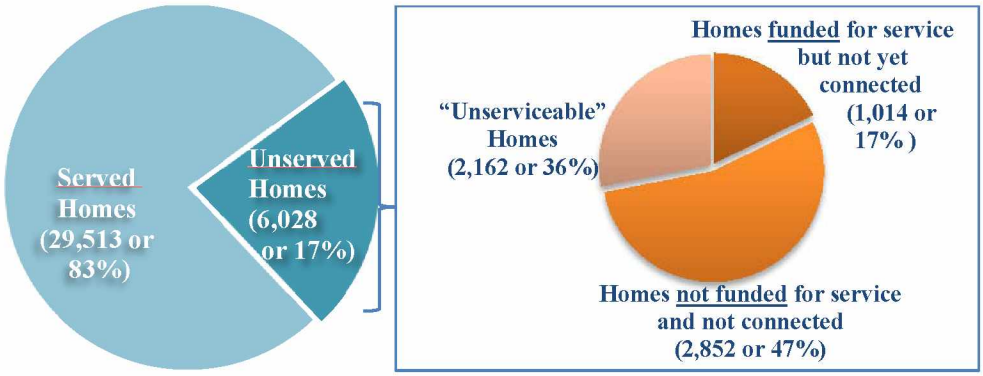

Figure 2.10. Categories of unserved homes[51]

It is important to emphasize that operation and maintenance needs are excluded from estimates in Figure 2.9 and Figure 2.10, as they are considered the responsibility of communities and are not eligible for federal funding. Likewise, the projected needs represented in Figure 2.7 only include needs related to "Upgrades or Replacement to Address Substantial Health Threats" and "First Time Service for Homes without Piped or Covered Haul Water and Sewer,"[52] leaving approximately $200 million for "Upgrades to Benefit Systems Operation or to Address Minor

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agencies definition of "rural" and includes larger communities and regional hub communities. Only year round occupied homes were included in this data.

[50] As defined by ADEC, an unserviceable home is one that is located in an area where septic tanks and wells are not feasible and is too far away from the "core" area of a community making extending piped service or providing vehicle access for flush/haul vehicles unreasonably expensive.

[51] Griffith, "Overview of Funding and Needs for Rural Alaska Water and Sewer Improvements," 6.

[52] These two categories are typically combined and referred to as "critical health needs" by the agency.

Health Threats" outside of projections. Figure 2.11 combines these three categories and their corresponding estimates in U.S. dollars highlighting the slice of the pie that is not being considered in the projected needs illustrated in Figure 2.7.

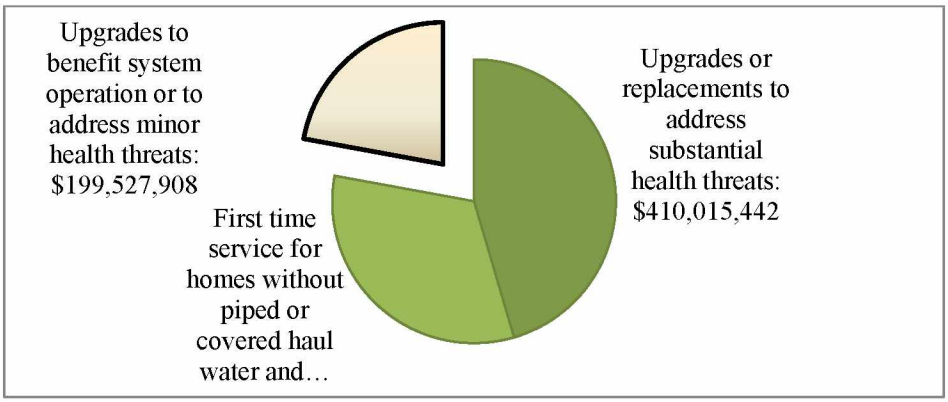

Figure 2.11. Categories of project needs (January 2013)[53]

Based on recent construction costs and current house count information, ADEC has projected that the estimated cost to provide first-time service to all unserved homes would range from $600 million to $900 million. Moreover, provided that annual funding remains constant at $65 million and assuming that it would be split 60/40 between first-time service ($39 million) and upgrades ($26 million) servicing all remaining homes would take 19 years (until year 2031).[54]

According to Bill Griffith, the agency has been dedicating about 60 percent of funds to first-time service needs, about 40 percent to regulatory compliance and essential upgrade needs, and no money has been spent on beneficial (or desired) upgrades due to the agency's insufficient funds. Griffith

[53] Griffith, "New Approaches to Basic Water and Sewer Service," 4.
[54] Information provided by Bill Griffith during interview, document on file with the author.

acknowledged that this is not a financially sustainable way of providing the basic public service of access to safe water and sanitation: "[Because of] the reality that the funding gap is getting bigger and not smaller, there is growing appreciation for the fact that we're not going to close that gap with the given funding trends. . . . We have to begin looking at something different."

Such upgrades to water plants and service-related infrastructure are critical to meeting current regulations and improving energy efficiency to reduce heating costs involved in service delivery; the last being of particular relevance to reduce the overwhelming costs of fuel, a resource that is non-renewable and not locally produced.

How is the agency planning to address the widening gap between needs and funds?

In 2011, the United States Arctic Research Commission (USARC) advised[55] the agency to focus on three objectives:

1. Maximizing funds that the agency receives every year (approx. $65 million);
2. Looking at opportunities to enhance the operation and maintenance (O&M) of engineered systems such as, for example, creating subsidy programs or more effective technical assistance programs;
3. Focusing more efforts toward research and development on new approaches to the problem.

The third recommendation in particular has been overlooked as the agency has in recent years emphasized maximizing funds and looking for ways to enhance O&M.

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[55] USARC has organized workshops specifically for water and sanitation in the Arctic since 2011. These are not open to the public or the industry but they make most presentations materials and meeting minutes available online. Meeting archives available at http://www.arctic.gov/meeting_archive.html

However, keeping apace of research and development efforts, officials at ADEC and EPA are now trying to think outside the current approach, looking for innovative ideas to design affordable infrastructure. In the spring of 2012, Griffith and EPA official Dennis Wagner held meetings with various representatives from research institutions in Fairbanks to discuss potential initiatives including decentralized and creative means of providing running water and sewer services in rural Alaska. Bill Griffith explained that innovative alternatives suitable for rural Alaska are not available off the shelf commercially; they are yet to be developed by working closely with rural community residents.

On the other hand, given that the current funding trends from federal agencies and the state legislature are not adequate to serve remaining homes and make needed improvements, enhancing operation and maintenance (O&M) of active water and sewer systems is critical to sustaining delivery of this service. The U.S. is one of the few nations that does not provide a federal subsidy for O&M of rural systems. Dennis Wagner explained: "Every penny of the $2 billion my colleague mentioned before went to capital construction costs. We don't have the authority either from the state or the federal side to pay for operation and maintenance costs."

The lack of financial support for O&M of fuel-dependent systems in rural Alaska (where cash economies are weak and employment opportunities scarce) hinders the overarching goal of enabling sustained access to clean drinking water and sanitation in villages. Therefore, public officials, Bill Griffith among them, have repeatedly brought this funding gap to the attention of Alaska's legislators in the recent years:

> Last week, I provided the legislature with papers and materials informing on what makes Alaska different than other Arctic communities. Our waste water and drinking water regulations are the most stringent in the world. Many Arctic nations including Canada, Greenland, Russia, allow

> raw sewage to be discharged into oceans and rivers. We don't have that option. If we did, we could provide service at a fraction of the cost. There would be no need for building sewage lagoons, sewage treatment plants and community drain fields. Other nations allow water for bathing and washing purposes to be treated to meet standards lower than that for drinking water as long as there is a place in town for individuals to collect safe drinking water. We don't have that option either. Ultimately, the U.S. is probably the only Arctic nation—we haven't quite been able to confirm this—that doesn't provide a federal subsidy for O&M. Virtually every other northern nation provides a subsidy to operate and maintain systems once constructed in recognition that by doing it they save money in the long run.

Although garnering state funding for O&M will be daunting, it appears that this solution is more likely than securing federal support because changes in federal regulations including a hypothetical federal subsidy for O&M would arguably have to apply to the whole nation.

Regional politics in Alaska present a high barrier to state funding of O&M, however. Legislators representing urban residents may perceive no political gain in funding such programs for rural Alaska. Political representation is based on population and the majority of the state's population (about 80 percent) resides in the largest cities, Anchorage, Juneau, and Fairbanks. There are relatively few members of the legislature who represent the rural districts where village residents are affected by the funding shortage for O&M of water and sewer systems.

Thus, obtaining state funding will be difficult. "There is a lot of resistance even in the Alaska legislature for that because it would be an ongoing cost, not something you can fund once and walk away from," added Griffith. Although, theoretically, a governor could propose such a subsidy, the legislature must still approve the state budget, so legislators representing the 80

percent of the population would still have to be convinced that said subsidy was in the best interest of the state.

Non-Financial considerations

Water systems and utilities are managed by individuals, and the service aims to serve individuals. Therefore acknowledging and studying the interplay between the human dimension and the provision of this service, as well as identifying strengths and weaknesses of the public program, is just as important as analyzing the financial challenges and impacts of engineered water systems. Doing so can help form a more complete understanding that can potentially lead to a more efficient management of this service.

However, few resources have been invested in exploring the human dimensions. The following paragraphs offer insight into information on this topic gathered through academic and grey literature as well as discussions with knowledge experts.

This investigation suggests that there may be an erroneous assumption that western standards for life quality, including drinking water and sanitation standards, are generalizable. For instance, Elizabeth Marino[56] presents the case of a rural community avoiding the use of treated water due to cultural perceptions of what is considered "healthy" water. Marino argues that policymakers and infrastructure designers should take into consideration the world view of end-users if they want the policy and project to succeed. Another consideration must be financial capacity. Although lack of in-home access to clean water has negative implications for public

[56] Elizabeth Marino et al., "Drinking Water in Northwestern Alaska: Using or Not Using Centralized Water Systems in Two Rural Communities," *Arctic* 62, no. 1 (2009): 79.

health,[57] in some villages water utilities are so prohibitively expensive that rural residents avoid using these services to save money.[58]

High prices can also weaken traditional values such as sharing. Eichelberger (2012) found cases of village residents feeling compelled to charge their parents for sharing or hauling of water as this constitutes an expense that they cannot afford (the cost of water itself and fuel money for hauling and transporting water). In this sense, expensive water utilities are not only a strain on the wallets of village residents but could also represent the undermining of cultural values such as sharing, a key component of many traditional subsistence economies.

Political promises, such as that of Gov. Knowles, driving the goal of providing "state-of-the-art" systems in all Alaska villages[59] also presents a potential conflict between maintaining traditional skills related to self-reliance (particularly emphasized by the Athabascan people in the Interior region) on the one hand and developing increasing reliance on highly sophisticated utilities systems on the other. Such systems are prone to breaking down and require skilled maintenance personnel to keep them running, not to mention continued high levels of funding.[60] Prioritizing the provision of modern utilities in every village, regardless of their local capacities may not only be impractical but may be detrimental to the well-being of local residents and to their culture because such amenities can contribute to increased dependence. Such dependence may be on flows of financial or technological support from outside the village and/or on a

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[57] Hennessy et al., "The Relationship Between In-Home Water Service and the Risk of Respiratory Tract, Skin, and Gastrointestinal Tract Infections Among Rural Alaska Natives," 2072, 2074-2078; Jay Wenger et al., "Invasive Pneumococcal Disease in Alaskan Children Impact of the Seven-Valent Pneumococcal Conjugate Vaccine and the Role of Water Supply," *The Pediatric Infectious Disease Journal* 29, no. 3 (2010): 251, 254-256.
[58] Eichelberger, "Living in utility scarcity: energy and water insecurity in Northwest Alaska," 1016.
[59] In reference to former Alaska Gov. Knowles' initiative to put the honey bucket in the museum in the mid 1990s. Thomas and Enge.
[60] Eichelberger, "Living in utility scarcity: energy and water insecurity in Northwest Alaska," 1012.

centralized water treatment and distribution method. Thus dependence can render a village vulnerable in highly probable scenarios of declining external funding or infrastructure malfunctions that interrupt access to clean water and sanitation. Breakdowns of these systems may lead to the need for additional funds and public health threats directly affecting the community's well-being and sustainability.

Research conducted by Lilian Alessa et al. in the Seward Peninsula (Northwest Alaska) suggest that engineered water systems that provide running water at home may "distance" residents from the resource, impeding their ability to perceive changes in water quality and quantity in the natural environment.[61] In communities with subsistence lifestyles "distancing" can represent vulnerability, as residents depend heavily on interactions with their ecosystem for securing their livelihoods (e.g. fishing and hunting). However, arguments against engineered water systems ought to be balanced with the significant finding that a lack of in-home water service in villages is associated with higher respiratory and skin infection rates as well as invasive pneumococcal disease in children.[62] The latter can result in middle ear infection, pneumonia, meningitis (inflammation of the coverings of the brain and spinal column) or bacteremia (a bloodstream infection).[63] Public programs that serve basic needs such as the provision of water and sanitation directly impact the sustainability of Native communities. Nevertheless,

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[61] Lilian Alessa, Andrew Kliskey, and Paula Williams, "The distancing effect of modernization on the perception of water resources in Arctic communities," *Polar Geography* 30, no. 3 (2007): 175, 188; ------, "Forgetting Freshwater: Technology, Values, and Distancing in Remote Arctic Communities," *Society & Natural Resources* 23, no. 3 (2010): 254, 261-266.

[62] Hennessy et al., "The Relationship Between In-Home Water Service and the Risk of Respiratory Tract, Skin, and Gastrointestinal Tract Infections Among Rural Alaska Natives," 2072, 2074-2078; Wenger et al., "Invasive Pneumococcal Disease in Alaskan Children Impact of the Seven-Valent Pneumococcal Conjugate Vaccine and the Role of Water Supply," 251, 254-256.

[63] New York State. Department of Health. "Pneumococcal Disease (includes pneumococcal pneumonia, pneumococcal meningitis and pneumococcal bacteremia)." http://www.health.ny.gov/diseases/communicable/pneumococcal/fact_sheet.htm (accessed March 2nd, 2013).

sociocultural considerations should inform the design of service delivery. The inclusion of local input is essential to ensuring that the resources needed for a sustained delivery of services are available.

Underscoring the importance of local input, the Alaska Commission on Rural Governance and Empowerment argues that the impact of government on the villages during the past quarter-century, while often materially beneficial in content, has been destructive in process.[64] With good intentions the government has delivered aid (e.g., funding for water and sewer) but has invested little or no time or money in developing the innate capacity of villages to tackle problems themselves. EPA official Joe Sarcone reports that villages and public officials experience a sense of hopelessness for having made all attempts possible to do their part in accessing or delivering safe water and sanitation.[65] Sarcone also identifies public officials as the "gate keepers"[66] of the access to water and sewer by operating with a set of solutions that is ill informed and culturally inappropriate. Such obstacles can discourage village actors from developing further initiatives, leading them to become more dependent on "outside help" to sustain their systems. It is important to note here that bureaucracy in general often clashes with traditional world views that emphasize pragmatism.[67] Therefore it is important to ponder how bureaucratic barriers to cross-cultural understanding inhibit the efficacy of local communities in mobilizing their human agency efforts or proactivity to achieve complex goals.

A report published in 2010 by the Denali Commission collects the insightful comments of federal agencies working on projects in rural Alaska regarding barriers to the sustainability of

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[64] Alaska Commission on Rural Governance and Empowerment, *Final Report to the Governor* (State of Alaska, 1999), 21.
[65] Sarcone, 350, 355-357.
[66] Ibid., 353.
[67] Scott Pratt, *Native Pragmatism: Rethinking the Roots of American Philosophy* (Bloomington: Indiana University Press, 2002).

rural communities. Interestingly, the U.S. Army Corps of Engineers denounces "complex layers" of government" or cross-scale governance impediments to project completion and success.[68] Another agency mentions a disconnect between policies of, for example, the Department of Housing and Urban Development and the Village Safe Water program; Indian Health Services could not fund sanitation improvements in housing that had been funded through Department of Housing and Urban Development.[69] This report also recommends dropping the policy of "putting the honey bucket in the museum" and acknowledging water and sewer systems that may seem substandard from a western perspective but may be suitable for villages if they qualify as decent, safe and sanitary.[70] The Office of the Secretary of the Interior also critiques the "top-down approach" and recommends collaboration.[71] The EPA points out that there is no "sustainability" definition shared by federal agencies as it pertains to Native villages. Individual federal agencies have presumed that by following their own legislative mandates and with support of Native Corporations, "federal programs will create and maintain homeostatic rural environments."[72] All these barriers have direct or indirect implications for the sustainability of rural water utilities in addition to affecting the ability to foster human agency at the village level.

Yet, the current discussion among service providers and the scarce literature published on this topic focuses largely on the lack of funds and more recently on looking for new technologies. Further initiatives for fostering local capacity or human agency should also be an important focus. We may be at the verge of a positive shift in policies considering the views shared in the 2010 Denali Commission report and the interest in finding new approaches to the problem (e.g.

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[68] Denali Commission, *Sustainable Rural Communities: A report by the Denali Commission in coordination with Federal Partners* (Anchorage, Alaska, 2010).
[69] Ibid., 51.
[70] Ibid., 43.
[71] Ibid., 64.
[72] Ibid., 69.

innovative and less costly sanitation technologies), but sustained access to water and sanitation in villages will continue to be at risk unless mechanisms are put in place for embracing pragmatism in seeking policy solutions, motivating human agency, and most critically, enabling cross-cultural understanding.

The following section presents many procedures involved in the delivery of this service in villages including funding mechanisms and the role that a community's capacity plays in the quest to acquire funding for water and sewer projects. In this process the interplay between actors and institutions following sets of rules at different scales of governance represents complexity rather than flux. This complexity was illustrated in Figure 2.4.

The public program for the delivery of clean water and sanitation in Alaska Native villages

The Drinking Water Program of the Division of Environmental Health at the Alaska Department of Environmental Conservation (ADEC) requires Public Water Systems (PWS) to be in compliance with the State of Alaska's drinking water regulations, in accordance with the United States Federal Safe Drinking Water Act and Amendments, for the public health protection of residents and visitors to the State of Alaska.[73]

Table 2.1 below lists the different categories of PWS that supply water to consumers, each having a specific set of requirements.

[73] Alaska Department of Environmental Conservation. "Drinking Water Program: Program Overview." State of Alaska. http://www.dec.state.ak.us/eh/dw/program_overview.htm (accessed February 11, 2011).

Table 2.1. Categories of public water systems

Categories of Public Water Systems	Types of Consumers
Community Water System	Expecting to serve at least 25 individuals or 15 residential service connections year round
Non-Transient Non-Community Water System	Regularly serves same 25 or more individuals for at least 6 months of the year
Transient Non-Community Water System	Neither of the above, regularly serves at least 25 individuals each day for at least 60 days of the year
Class C Public Water System	Neither of the above, and not a private well or private water system

The drinking water regulations set the standards for safe drinking water depending on the PWS's category. They also identify the regulated drinking water contaminants and the levels of those contaminants allowed in the water. The types of contaminants the Drinking Water program regulates include bacteria, viruses (e.g. from septic systems) and parasitic protozoans; lead and copper; nitrate and nitrite (commonly from septic systems and manure piles); heavy metals (e.g. arsenic and cadmium); volatile organic contaminants (e.g. benzene and gasoline); and synthetic organic contaminants (e.g. pesticides and herbicides).[74]

Community water systems require extensive expertise on the part of operators and continual maintenance including safety assessments. Currently three technical assistance programs provide training and support for operating and running water utilities in villages in the state. These are the State of Alaska's Remote Maintenance Worker (RMW) program, the Rural Utility Business Advisor (RUBA) program and Alaska Native Tribal Health Consortium's Tribal Utility Support Program (TUS). The RMW program works specifically with water plant operators, while RUBA does so with utility managers. TUS runs as a support program for both operators and utility administrators. Table 2.2 summarizes the scope of each of these programs.

[74] Ibid.

Table 2.2. Programs to develop capacity for managing and operating water systems

RMW[75]	**RUBA**[76]	**TUS**[77]
Funded by federal and state agencies to provide over-the-shoulder training and technical assistance to local water and sewer operators in over 180 rural communities through a circuit rider program. Provide immediate response to emergency situations that threaten or impact community water and sewerage facilities. Provide regional classroom training for area utility operators. Maintain an inventory of emergency repair equipment for loan to communities.	Provides assistance to small rural communities that are preparing to receive new or upgraded sanitation systems. Train and assist utility managers in paying electric bills, collecting user fees from residents, estimating how many hours the operator needs to work, and supervising that water testing is being done. However, RUBA is mostly known for the assessments they issue quarterly informing about indicators that measure the ability of different communities to manage and administer sanitation utilities.	Program is tribally funded at the national level and managed by Alaska Native Tribal Health Consortium in the State of Alaska. TUS staff offer training courses across Alaska for assisting water and sewer system operators and managers. This program also manages the Alaska Rural Utility Collaborative (ARUC) and the Alaska Utility Supply Center (AUSC). ARUC is a statewide program that manages, operates, and maintains water and sewer systems in partnership with rural communities. AUSC is a "one-stop shopping" resource for operators where materials and equipment for maintenance and operation are available at discounted prices.

On a community basis, the EPA offers the Indian General Assistance Program (IGAP), whose primary purpose is to develop capacities among tribal members in all respects, not specifically with water and sewer. This program is available to communities but not necessarily to a water utility. However, in some cases, the utility can benefit from this program; for instance, an IGAP coordinator might move over to the management of the water utility at some point. Such

[75] ------. "Remote Maintenance Worker Program." State of Alaska. http://dec.alaska.gov/water/rmw/index.htm (accessed February 26, 2013).
[76] Community Department of Commerce, and Economic Development. "Rural Utility Business Advisor (RUBA) program." State of Alaska. http://commerce.alaska.gov/dca/ruba/ruba.htm (accessed October 10, 2012).
[77] Alaska Native Tribal Health Consortium. "Tribal Utility Support Program." http://www.anthctoday.org/dehe/tribal_util.html (accessed February 11, 2013).

transfers are common in small communities of the Interior region as people move from job to job or occupy more than one position at the same time.

Allocating government funds to water and sewer projects

The process for seeking government funding for a public water and sewer systems is daunting, despite the fact that engineers assist village residents in developing their proposals. In short the process is as follows:

For project administration purposes, an engineer is assigned to every village for water and sewer works. A village contacts the engineer who has been assigned to the village to let him or her know of its sanitation needs. In coordination with the village, the engineer develops a proposed design and budget for the project. This project and funding request are entered into a collective database of needs that is updated every year. Then, state and federal agencies rank the project proposals using a scoring rubric that focuses on health impacts resulting from the proposed project, as well as ability of the communities to operate and maintain these projects. Qualifying proposals are funded depending on the federal and state available funds for the fiscal year.

Figure 2.12 illustrates the primary sources of funding for sanitation improvement in rural Alaska. The barrels[78] across the top represent sources of funding. The numbers in the barrels are three year averages from 2008 through 2010.[79]

[78] Known as the "barrel chart" by public officials.
[79] Officials try to update these numbers every year or two.

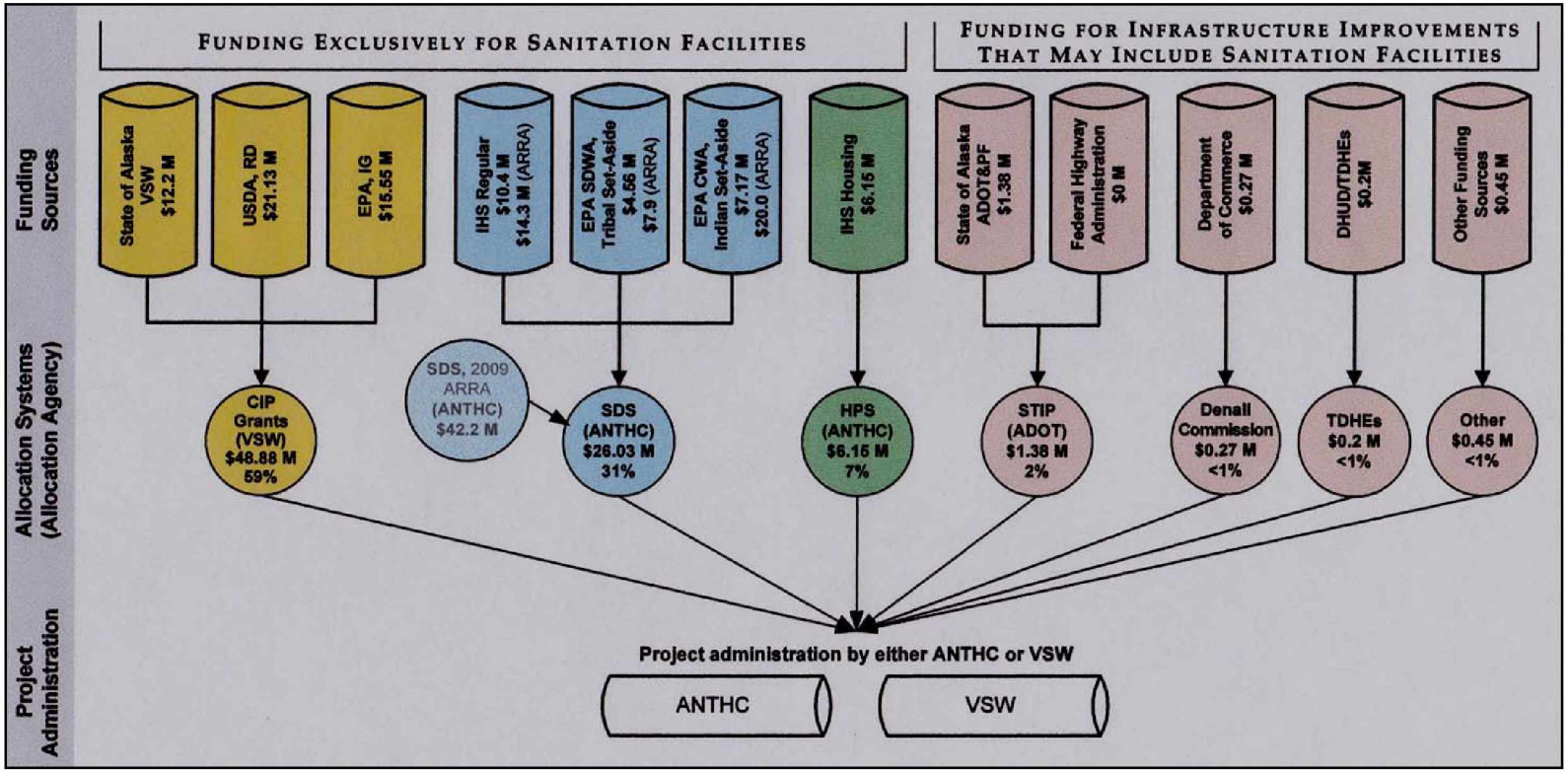

Figure 2.12. Primary sources of Alaska rural sanitation facility improvement funding: Three-year average of federal fiscal years 2008 - 2010 (i.e., an average of $83.36 million was annually allocated)[97]

[97] Adapted from Alaska Native Tribal Health Consortium. "Web-based Sanitation Deficiency System: Reference Materials 2012 Update." http://anthctoday.org/documents/wSDS_Manual_2012_Update.pdf.

Starting on the left, funds from the Environmental Protection Agency (EPA, Infrastructure Grant) and the United States Department of Agriculture (USDA, Rural Development) are made available by Congress through the State of Alaska, with Congress requiring a 25 percent match originated in local funds. This stream has traditionally offered the largest source of funding. However, this stream has also experienced the greatest decline in funding.[98] "While over these three years [2008-2010] it represented about 59 percent of the money, it is probably below 50 percent today," explained Bill Griffith, Manager of the Facility Programs office at Alaska Department of Environmental Conservation.

Moving to the right on the graph, the next three sources are all tribal funds including the Indian Health Service (IHS) general funds, the EPA Safe Drinking Water Act Tribal Set-Aside Program, and the Clean Water Act Indian Set-Aside Program.[99] The funding from these sources is made available to Native communities nationwide by a set formula. This allocation does not rely on action by Alaska's delegation in Congress. According to ADEC officials, this stream has traditionally provided a smaller portion of the funds for water and sewer systems in Alaska, although it has remained consistent over the last 10 or 15 years.

At the center of the diagram, IHS housing contributes a relatively small amount of funding, based on a formula of funding awarded to Native communities. The remaining barrels on the right are sources of funding for infrastructure improvements that are not specific to sanitation

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[98] The funds originated in the 2009 American Recovery and Reinvestment Act were a one-time addition to the bulk of funding for 2008-2010.

[99] The Indian set-aside grants are awarded for the planning, design, and construction of waste water treatment facilities for American Indian and Alaska Native tribes. The grant program is administered by EPA in cooperation with the IHS and uses the IHS's Sanitation Deficiency System (SDS) to identify high-priority waste water projects for funding. The SDS ranks tribal sanitation deficiencies according to five deficiency levels, ranging from communities that need only routine waste water system maintenance to communities that do not have adequate waste water facilities. This information was retrieved from the Nonpoint Source Management Program Plan prepared for the Ute Mountain Ute Reservation of Colorado, New Mexico and Utah.

facilities but may have some effect on them, e.g. roads to landfills or roads to lagoons. These funds typically constitute a very small portion of the overall funding.

Funding allocation mechanisms

Funds released by these agencies are currently made available primarily through two funding allocation systems: Village Safe Water (VSW) Capital Improvement Program (CIP) grants run by the State of Alaska[100] and the Sanitation Deficiency System (SDS) funded by the IHS and administered by the Alaska Native Tribal Health Consortium (ANTHC). Thus funds allocated by these programs are drawn from both state and federal funding sources.

Both of these funding allocation mechanisms use a scoring rubric based on specific criteria that assigns each community a score. This score determines the community's position on the ranking list. The two systems differ, however, in the number of points each system grants per criterion. Once the projects are ranked, as many will be supported as the funding for a given year allows.

While the formula for funding water and sewer projects is very complex and outside the control of village residents, other elements of the process involved in the development and implementation of water and sewer systems require greater agency on the part of villages seeking the infrastructure.

Phase 1: Coordinating with the assigned project engineer

The first step in the process of acquiring a water and sewer system is to register the village's interest in such a system with the state. Each community pursuing a water and sewer system is assigned to work with an engineer either at the State of Alaska's Village Safe Water

[100] It is important to mention that the name may imply it is all state money. However, note in the "barrel chart" that the state's contribution is backed up by federal dollars as well.

(VSW) program or at the Alaska Native Tribal Health Consortium (ANTHC). Communities throughout the state are divided roughly evenly between VSW and ANTHC for efficiency and equity.[101] In some cases, a community project is initially funded either by federal or state dollars and thus assigned an engineer accordingly. If the lead agency for the project has not changed over the years, the community is likely to continue working with the same engineer unless it chooses to work with a different one. The assigned engineer enters information on what he or she considers to be the project needs into a system database to compete for funding. Each project is issued a score and it may be funded, if the available funding goes far enough down the ranking list to the said project. The Office of Environmental Health (OEH) at the Tanana Chiefs Conference (TCC) assists villages in the Interior region by informing engineers what they consider appropriate systems and fundable projects, which helps villages to score better vis-à-vis villages located outside this region.

To illustrate this process, Bill Griffith, Facility Programs Manager at the ADEC offered the following example:

> For thirty years ANTHC–or IHS, as previously known–was the lead agency in Chignik Lagoon. Regardless of where from the money (has or will come) ANTHC has had the same engineer running projects there for 5 or 10 years. At the same time, Village Safe Water has been the lead agency in Napaskiak for 20 years . . . so if [communities] are looking for money, they just call up the engineer assigned to work [with them] and say, "What's going on? Our water project seems to have stalled out." Then, that engineer needs to be prepared to explain, for example, "We had a grant from this funding source. It was for $2 million [our] original estimate, but as we got into construction, we realized it was going to cost an extra million. This summer, we're pursuing both funding sources,

[101] Villages have been assigned to an engineer in one or the other agency for decades.

> [federal/ANTHC and state/VSW]. Hopefully, by next year we'll have the funding in place to finish the project.

The agency rationale behind nominating an engineer as the liaison between the communities and funding agencies is to provide expertise in design as well as knowledge of the funding bureaucracy. The various funding sources and allocation systems make the navigation of the process for acquiring water and sanitation infrastructure funding a rather complex endeavor. "The agency wants to keep it simple at the community level, that's why we've got an engineer assigned to each community. Communities and engineers should be working together," said Griffith. Communities can contact their engineers to discuss their sanitation needs, how the work of the engineer is progressing, and how community members can assist in the process.

Phase 2: Entering a funding request for a sanitation project into the database

After a community has acquired a water or sewer system, it must enter its needs for infrastructure replacement or upgrades into a list or database of needs called the Web-based Sanitation Deficiency System (WSDS).[102] This data entry routine is repeated annually to maintain an updated database of needs for the state of Alaska. Once projects to be funded are identified, the funding allocated to each project is administered either by ANTHC or the state VSW program, based on who the lead agency (engineer) is in a given community.

The application process for both new and existing systems used to take place at different times of the year and the two systems were not treated as one process with the common goal of funding water and sewer projects. This has changed, however, and the two processes have

[102] There is a booklet available online containing 136 pages that serves as a good resource to better understand this process as well as illustrate how daunting this process can be. Web-based SDS Reference Materials: http://www.anthctoday.org/documents/wSDS_Manual_2012_Update.pdf

merged into one. After tribes register their needs with the SDS database, EPA and IHS determine which new or ongoing projects to fund based on the SDS ranking and available funds.

Figure 2.12 shows primary sources for the funding of improvements to Alaska rural sanitation facilities. The first six circles from the left representing "Allocation Systems" draw from the one list of needs compiled by the Web-based Sanitation Deficiency System (WSDS). Using WSDS as the collective database of projects needing funding eases the process for village administration purposes, because instead of monitoring different deadlines and funding request requirements, communities only have to submit one funding application once a year to be considered for all sources of funding.[103]

Hence, if a community needs a new treatment plant it will be entered to the database of needs and considered by all six funding entities. This is an advantage that Alaska Native communities enjoy as this is not the case for tribes in the lower forty-eight.[104] Native communities south of Alaska may have to apply three or four different times for funding for one project. "Up here, because of the coordination between the agencies, communities only have to enter their need once a year to be considered by all programs," explained Dennis Wagner, of the Region 10 Alaska Operations Office at the EPA.

A water or sewer project can score relatively low on one of the priority systems (CIP or SDS) but score very high on the other. In this case, the community does not need to apply twice because both systems draw from the same list of funding agencies and the project can be funded through one of the two allocation mechanisms even though it scored low on the other. If the

[103] For example in 2011, deadline for project managers/engineers to enter all data relating to sanitation deficiency projects into the database for funding allocation consideration by SDS and CIP was June 10.
[104] This is how Alaskans refer to the contiguous forty-eight states of the Nation located at lower latitudes, south of this state and Canada.

project scores high on both, the funding agencies will decide which (CIP or SDS) will fund the project relieving the village of being involved in the decision.

Phase 3: Applying the scoring criteria for the allocation of funds to water and sewer projects in Alaska Native villages

Table 2.3 below shows the scoring criteria for construction projects by category in the left column and the total possible points in the two columns on the right. CIP points are granted by the state's VSW program and SDS points by the IHS through ANTHC. The SDS scoring rubric is used nationwide to identify high-priority waste water projects for funding in American Indian tribes across the United States, whereas the CIP allocation system is Alaska specific. SDS ranks tribal sanitation deficiencies according to five deficiency levels ranging from communities that need only routine waste water system maintenance to communities that do not have adequate waste water facilities. Projects are prioritized in both systems based on the extent of health benefits to be delivered and a community's ability to sustain the operation of their water systems. Bill Griffith reported that the latter is a capacity that is rather difficult to develop and retain:

> Health Impact accounts for 35 percent of all the points on the state system (CIP) and about 30 percent of all the points on the national IHS system (SDS), making Health Impact the largest point category with the exception of the Local Capacity category, which is the community's ability to operate and maintain their existing facilities. This is a rather difficult thing to gauge because the community can be very dependent on one or two individuals [knowledgeable about operation or administration] who could suddenly walk away. Next day, the community finds itself in an entirely different situation.

Table 2.3. Construction project scoring criteria for calendar year 2010[105]

Category	Criterion	CIP Points	SDS Points
Health Impact (limited to one)	**First Service**: Majority of project costs are associated with providing fully piped, closed haul, or onsite water and waste water service to homes not previously served at the proposed service level.	350	30
	Regulatory Compliance: Majority of project costs are associated with addressing "verified" facility-related regulatory compliance. (DEC drinking water or waste water program verification required).	300	25
	Essential Upgrades: Majority of project costs are associated with water/sewer system upgrades or replacement of existing system components that have exceeded their capacity or design life, resulting in present and continuous compromises in health benefits of system and representing a clear and substantial health hazard.	175	15
	Beneficial Upgrade: Majority of project costs are associated with upgrades to increase operational efficiencies or system component upgrades that address intermittent compromises affecting the health benefits of the system. Includes all solid waste improvements.	50	7
	Desired Upgrades: Majority of project costs are associated with upgrades that are not considered "Essential Upgrades" or "Beneficial Upgrades" as defined above.	0	0
Project Status & Relationship to other Projects	Projects is related to other funded, non-sanitation infrastructure project(s)	75	-
	Other existing, mobilized water & sewer project(s) funded and scheduled for construction in 2011.	100	-
	Percentage of project cost contributed by agencies other than IHS.	-	8*
Deficiency Level	Initial deficiency level of homes served by project. (Highest deficiency level receives highest points.)	-	18*
Capital Cost	Cost-per-home in comparison with the average unit cost for the provision of all water, sewer, and solid waste services.	-	16*
Tribal Points	Assigned by Regional Health Organizations	-	16*
Application Quality	Information is complete and consistent throughout, and supports the goal of providing safe, sustainable water supply and sewage disposal to community residents.	75	-
Local Capacity	See Local Capacity Scoring Criteria details below	400*	16*
	Total Possible Points	**1000**	**104**

[105] Adapted from Alaska Native Tribal Health Consortium, "Web-based Sanitation Deficiency System: Reference Materials 2012 Update".

Within the category for health impact, first-time service projects receive the most points; bringing a system into regulatory compliance scores high as well. Griffith mentioned that agencies do not fund the beneficial upgrades and desired upgrades at all. From the agency perspective, if projects are not scoring high in the category for health impact, they do not enter into the funding range. The state agency does not want to see a project be half completed and stopped, therefore it emphasizes following through on ongoing projects.

As this official reported, local capacity (Table 2.4 below) is difficult to monitor and assess but it is the second most important criterion after health impact. Therefore the majority of points fall within these two categories.

Table 2.4. Local capacity scoring criteria for calendar year 2010[106]

Category	Criteria	CIP Points	SDS Points
Primary Operator Certification (limited to one)	Primary Operator is certified at the required water treatment level	105	5
	Primary Operator is certified for water treatment at any level	70	3
	Primary Operator is certified for water distribution, or waste water treatment or collection at any level	20	1
Backup Operator Certification (limited to one)	Backup Operator is certified at the required water treatment level	35	2
	Backup Operator is certified for water treatment or distribution, or waste water treatment or collection at any level	20	1
Utility & Financial Management	Utility Manager has completed a DCED-Approved Utility Management course or other college-level management training course	60	2
	Collection Rate is 85% or greater (documentation required)	75	2
Regulatory Compliance	System is not on the current Significant Non-Compliance List for violation of any operation-related violation(s)	125	4
Fluoridation	Community has successfully fluoridated for the previous calendar year. (See list of communities and additional information in SDS Reference Material)	-	1
	Total Possible Local Capacity Points	**400**	**16**

[106] Adapted from ibid., 28.

In the SDS scoring scheme, there are items that are unique to the tribal funding system such as tribal points. These pertain to the Indian Health Service (IHS) and regional tribal health organizations such as the Tanana Chiefs Conference and the Yukon-Kuskokwim Health Corporation. These are non-profit regional organizations responsible for providing health services, among other assistance. These health organizations prioritize projects in their regions and indicate which ones they want funded. Their perceptions of the projects' merit are valued.

Besides the health impact and other criteria, the agency assesses local capacity by breaking the field down into smaller categories. In the 400 CIP points and SDS 16 points assigned for local capacity (See Table 2.4) the agency considers whether a community has a primary operator certified as a result of training and testing; whether it has a backup operator or whether it has taken the time and initiative to identify someone for training; whether it has a trained utility manager and user fees are being collected; and whether the community system is in compliance from an "operational" point of view.[107] Finally, the Indian Health Service or SDS scoring scheme grants one point for fluoridation, although the State of Alaska (CIP) does not.

While discussing how a village scores points for local capacity, Griffith shared his concern on the suitability of this assessment tool:

> So this is the way we currently assess local capacity. This is an area, where frankly, additional thinking is probably warranted. I constantly struggle with the fact that I often don't think this may be the best way to assess local capacity, but it's what we currently have and we need to do something so we keep doing it. I'm not ready to throw it out the window and say 'Let's do nothing!' but, I really think we could come up with better ways. One of the challenges is, you've got to have something

[107] There are two kinds of regulatory compliance. First, things related to the water plant like having the right filter. Second, things like doing the necessary testing (e.g. bacteriological testing). The regulatory compliance assessed for here refers to the first.

> that's black and white or people will just argue, and you've got to have some evidence. For example, we can look up and see if the operator is certified, but if you're telling me, "Well, the operator is capable", I wouldn't be sure whether to give those points or not. We're told all the time, "Well, them having certification doesn't mean they know how to do their job" or "Operators know how to do their job but they can't pass the certification test." I can't tell whether they can or not do their job while I'm sitting in Anchorage looking at 300 other requests for funding. So, this is what we currently use.

Conclusion

This chapter has provided aspects of the demographic, socio-economic, cultural and financial contexts surrounding the delivery of water and sanitation services in rural Alaska. This included an overview of the overall process involved in managing and funding water infrastructure as well as the interplay among institutions at different scales of governance. Barriers to full service delivery were also explored in detail to help the reader understand why some Alaska Native villages are still undeveloped in terms of water utilities.

Despite the United Nations' declaration that clean drinking water and sanitation are essential to the realization of all human rights and Gov. Knowles' pronouncement that village honey buckets should be replaced by modern water utilities, a wide variety of systems ranging from none to fairly state-of-the-art water and sewage systems exist in Alaska's Interior. This variability reflects harsh terrain and climate conditions, small populations to support such systems, limited employment opportunities to support expensive systems, and shortage of highly skilled operators, among other challenges. While the scoring rubrics are important in evaluating and prioritizing projects for funding, they leave much to chance, especially with regard to local capacity.

3. RESEARCH DESIGN AND METHODS

> *"What has happened cannot be erased. We cannot return to the traditional nomadic ways of our ancestors. The communities that we live in now demand different skills from us. Our values will not change, but the skills and the means needed to maintain those values will be different."*
>
> —Alaska Native scholar, Edna Ahgeak MacLean

As noted in chapter1, this research project set out to explore how the provision of water and sewer service relates to community self-reliance. This responds to Athabascan community leaders' encouragement of academic research on community concerns such as strengthening self-reliance at the village level. A qualitative research design was employed to explore the perspectives of village residents on the delivery of water and sewer service to their communities to assess its impact on community self-reliance. Data were collected using in-depth, semi-structured interviews conducted either via telephone or in person. Residents of nine communities located in the Interior region of Alaska were interviewed. The question topics covered during interviews included the following:

- Identifying how village residents define the concept of "healthy water," as well as "healthy community," and "community self-reliance;"
- Exploring connections between water and sewer provisioning and community self-reliance;
- Discussing respondents' understanding of how the public program for water and sanitation delivery works; and

- Gaining insight into the strengths and weaknesses of the public program providing these services.

The following sections describe in more detail the design and performance of this study including the methods employed for gathering and analyzing primary data.

Rationale for qualitative research and reflexivity

The term qualitative research refers to a methodology or study process that investigates a social human problem with the researcher conducting the study in a natural setting to build a whole and complex representation through rich description and explanation as well as careful examination of respondents' words and views.[1]

The operationalization of the topics bulleted above may seem straightforward to state and federal policymakers, service providers, and even to the average person. However, it was both culturally appropriate and necessary to gather understanding on these concepts from individuals who were currently residing in a village and facing the problem under investigation in this study. During this study, I visited a few villages briefly but never resided full-time in one; nor am I of Alaska Native descent. Therefore I did not want to make assumptions, informed by my personal world view, as to what the village residents considered safe or healthy water only to later realize that I had been operating with an inaccurate assumption in my analysis.

The importance of healthy water to well-being or to a healthy community may seem a truism but my self-awareness as a researcher and outsider to the geographic, cultural, political, and economic context in which the participants live discouraged me from operating from my

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[1] John Creswell, *Qualitative Inquiry and Research Design: Choosing among five traditions*, 2nd ed. (Thousand Oaks: Sage Publications, 1998); Matthew Miles and Michael Huberman, *Qualitative data analysis: An expanded sourcebook*, 2nd ed. (Thousand Oaks: Sage Publications, 1994); Gareth Morgan and Linda Smircich, "The case for qualitative research," *The Academy of Management Review* 5, no. 4 (1980).

personal assumptions on the subject. I needed to know village residents' thoughts on whether access to water was indeed a local priority. It might have been that healing from cancer, coping with the loss of loved ones or care for the elderly were of higher concern than acquiring water systems to have running water in people's homes.

As for defining the concept of self-reliance, I was unable to find published works on self-reliance theory that were applicable to Alaska Native populations. However, more importantly, I considered it appropriate to let the participants shape this concept to operate with a definition of self-reliance that was grounded on their views. As previously mentioned, self-reliance is a long-standing value that has been practiced for generations in Alaska Native communities.[2] However, it is difficult to imagine that times of rapid cultural transformation and globalization have not affected the meaning of self-reliance. The Working Group on Rural Alaskan Self-Reliance also considered that, for starters, a clear understanding of this concept was needed prior to developing projects to strengthen community self-reliance. It seemed unlikely that by "self-reliance" tribal communities meant that they wanted to be left completely alone and isolated from the "outside" world to rely fully on themselves.

Research ethics: University and community approval and guidance

Based on my belief that circumstances unique to individual villages would shape rural residents' priorities and perceptions of self-reliance, I decided to inform this study by village level experience. Therefore village actors were the primary sources of expertise. However, discussions with professionals in key administrative agency positions and regional tribal organizations also offered a regional perspective of the issue under study. I sought expertise from

[2] Alaska Native Knowledge Network. "Athabascan Cultural Values." University of Alaska Fairbanks. http://ankn.uaf.edu/ANCR/Values/athabascan.html (accessed January 31, 2011).

officials at the Alaska Department of Environmental Conservation, the Environmental Protection Agency (Alaska Region 10), the tribal organization Tanana Chiefs Conference and the Alaska Native Tribal Health Consortium. Their expertise was invaluable. Their guidance was particularly helpful for composing my interview questions.

Prior to conducting the interviews, appropriate Institutional Review Board (IRB) Human Subjects protection was obtained through the University of Alaska Fairbanks (UAF) Office of Research Integrity to ensure protection of the participants.[3] I also informed the tribal non-profit organization in the region, Tanana Chiefs Conference, of the development of this study. Staff members at the Office of Environmental Health (OEH) of TCC were particularly helpful during the initial phase of this study by discussing with me issues that Interior villages were facing in regard to water and sewer service delivery, thus helping me design the study. Staff at OEH, TCC Health Services, as well as the president of TCC at the time (Summer 2011) reviewed the questions in my interview guide. I also took the opportunity to present my study to Native community members at the Denakkanaaga Youth & Elders Conference in the Native village of Nulato in June of 2011. There I distributed informational flyers to representatives of various villages. Jerry Isaac, president of TCC, was one of the attendants at this conference. Later, he provided a letter of support to this study (Appendix A) which I enclosed in the invitations to participate that I sent out during the recruitment stage of this study.

[3] IRB Waiver # 235172-1.

Research paradigm: A researcher's world view

A research paradigm is a set of interconnected assumptions about the social world which form the basis of a philosophical and conceptual framework used for studying such world.[4] The research process is guided by the researcher's beliefs and feelings about the world, how it should be understood, and how it should be studied.[5] Thus the basic beliefs and world views of researchers lie behind their theoretical perspectives.

A researcher's paradigm or world view can be inferred by how the researcher would answer the following questions:

- What is the form and nature of reality that can be known by a human being? (Can we uncover "The Truth"? – ontology)
- What is/should be the relationship between the researcher and the participants? (epistemology)
- How can/should the researcher go about finding what the researcher believes can be known? (methodology)

Guba and Lincoln[6] argue that researchers need to make explicit both their ontological and epistemological assumptions before embarking on any research project. Answering the ontological question, "What is the form and nature of reality and, therefore, what is there that can

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[4] William Filstead, "Qualitative Methods: A Needed Perspective in Evaluation Research," in *Qualitative and quantitative methods in evaluation research*, ed. Thomas Cook and Charles Reichardt(Beverly Hills: Sage Publications, 1979), 34.
[5] Norman Denzin and Yvonna Lincoln, *Collecting and Interpreting Qualitative Materials* (Thousand Oaks: Sage Publications, 1998); Priscilla Ulin, Elizabeth Robinson, and Elizabeth Tolley, *Qualitative methods in public health: A field guide for applied research* (San Francisco: Jossey-Bass, 2005).
[6] Egon Guba and Yvonna Lincoln, "Competing paradigms in qualitative research," in *Handbook of qualitative research*, ed. Norman Denzin and Yvonna Lincoln(Thousand Oaks: Sage Publications, 1994).

be known about it"[7] is the first step in the definition of how researchers can approach a research problem.

The interpretive researcher's ontological assumption is that social reality is locally and specifically constructed[8] by humans as they act and interact with others.[9] Lawrence Neuman[10] affirms that social reality derives from peoples' perceptions of these actions and interactions. Based on these assertions, interpretive researchers do not recognize the existence of an objective world. On the contrary, they see the world strongly bounded by a particular time and specific context.[11] Hence, the epistemological question, "What is the nature of the relationship between the knower or would-be knower and what can be known"[12] ought to be answered in a consistent way with the ontological view.

The interpretive researcher's epistemological assumption is that findings are constructed through the process of the investigation.[13] Furthermore, interpretive researchers explicitly recognize that understanding the social reality in a given situation requires comprehending how practices and meaning develop through use of language and implicit norms by humans with shared goals.[14]

Being in agreement with these philosophical assumptions, I identify myself as an interpretive researcher. An interpretive (or constructivist) world view is opposed to a positivist

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[7] Ibid., 108.
[8] Ibid.
[9] Wanda Orlikowski and Jack Baroudi, "Studying information technology in organizations: Research approaches and assumptions," *Information Systems Research* 2, no. 1 (1991): 14.
[10] Lawrence Neuman, *Social research methods: Qualitative and quantitative approaches* (Boston: Allyn and Bacon, 1997), 69.
[11] Antonio Díaz Andrade, "Interpretive Research Aiming at Theory Building: Adopting and Adapting the Case Study Design," *The Qualitative Report* 14, no. 1 (2009): 44.
[12] Guba and Lincoln, 108.
[13] Ibid., 111.
[14] Orlikowski and Baroudi, "Studying information technology in organizations: Research approaches and assumptions," 14.

approach in that, according to the latter, the person (researcher) and the reality are separate. According to the positivist approach, objective reality exists beyond the human mind and the research object has inherent qualities that exist independently of the researcher. I explicate below the contrasting interpretivist perspective, the stance I am using in this qualitative study.

The interpretive approach: A researcher's stance

Interpretive researchers aim at theory building through an inductive thinking process. The interpretive approach allows deep insight into "the complex world of lived experience from the point of view of those who live it."[15] Interpretive research assumes that reality is socially constructed and that the researcher becomes the vehicle by which this reality is revealed.[16] The researcher's interpretations play a key role in this kind of study bringing "such subjectivity to the fore backed with quality arguments rather than statistical exactness."[17]

It is necessary to clarify that qualitative research and the interpretive approach are by no means equivalent and interchangeable terms.[18] Interpretive research assumes "that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools, and other artifacts;"[19] whereas qualitative research is a rather broad term referring to a methodology that may or may not be interpretive depending upon the

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[15] Thomas Schwandt, "Constructivist, interpretivist approaches to human inquiry," in *Handbook of qualitative research*, ed. Norman Denzin and Yvonna Lincoln(Thousand Oaks: Sage Publications, 1994), 118.

[16] Robert Cavana, Brian Delahaye, and Uma Sekaran, *Applied business research: Qualitative and quantitative methods* (Milton: John Wiley & Sons Australia, 2001); Geoff Walsham, "The emergence of interpretivism in IS research," *Information Systems Research* 6, no. 4 (1995); ------, "Interpretive case studies in IS research: Nature and method," *European Journal of Information Systems* 4, no. 2 (1995).

[17] Lucia Garcia and Freddie Quek, "Qualitative research in information systems: Time to be subjective?," in *Information Systems and Qualitative Research*, ed. Allen Lee, Jonathon Liebenau, and Janice DeGross(London: Chapman and Hall, 1997), 459.

[18] Heinz Klein and Michael Myers, "A set of principles for conducting and evaluating interpretive field studies in information systems," *Management Information Systems Quarterly* 23, no. 1 (1999); Neuman.

[19] Klein and Myers, "A set of principles for conducting and evaluating interpretive field studies in information systems," 69.

philosophical assumptions of the researcher. The discussion below describes the specific nature of the methodology used in this study.

Grounded theory methodology

To ensure that the study findings and interpretations would be based on the local perspectives and circumstances, no pre-existing theoretical framework was applied in this study. Instead, elements of a grounded theory methodology were used to develop an understanding based in the multiple perspectives of participants, as collected through interviews that addressed the phenomena under study: The delivery of water and sanitation and its relationship to community self-reliance in nine Alaska Native villages located in the Interior region of Alaska.

I chose this methodology owing to the lack of data or previously published studies on the relationship between community self-reliance vis-à-vis the delivery of water and sewer services in Alaska Native villages.

Grounded theory, "the discovery of theory from data"[20] provides the opportunity for the researcher to theorize from evidence existing in the data. The major advantage of grounded theory is its inductive, contextual, and process-based nature.[21] These characteristics are particularly useful for an interpretive researcher.

The following sections describe procedures and methods I applied to this study, including criteria for selecting study participants, sample size determination, recruitment of study participants, data collection and management, as well as data analysis.

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[20] Barney Glaser and Anselm Strauss, *The discovery of grounded theory: Strategies for qualitative research* (Chicago: Aldine Publishing Company, 1967), 1.

[21] Kathy Charmaz, *Constructing grounded theory: A practical guide through qualitative analysis* (London: Sage Publications, 2006); Wanda Orlikowski, "CASE tools as organizational change: Investigating incremental and radical changes in systems," *Management Information Systems Quarterly* 17, no. 3 (1993); Strauss and Corbin.

Seeking participation from Interior villages

Athabascan leaders of Interior Alaska developed a list of tribal goals and values at the annual Denakkanaaga Elders Conference of 1985.[22] Among the expressed true values or social norms that have guided Alaska Native living for generations, self-reliance was enlisted first. Based on this long-standing list of community values, I preferred to use the Native concept of "self-reliance" over western concepts such as "sustainability" or "resilience." Since the 1985 Denakkanaaga Elders Conference, the list of social norms has been disseminated through tribal promotional materials such as posters on "Athabascan cultural values." These posters are published and distributed by the Alaska Native Knowledge Network[23] and can be found posted on the walls of the Tanana Chiefs Conference building in Fairbanks, and in the offices of many other tribal organizations throughout the Interior region of Alaska (e.g., village council offices, health centers, schools, community halls, village airports). Additionally, I considered the Athabascan leaders' appeal for research projects addressing "community self-reliance"[24] and decided to target villages located in the Interior region for conducting the interviews.

Villages in the Interior region are primarily represented by the non-profit tribal consortium Tanana Chiefs Conference (TCC). Funding and capacity development for improving access to safe drinking water are among the health and social services that TCC provides to villages. In addition to seeking the participation of villages served by TCC, I selected respondents from the pool of communities designated as "very distressed" by the Denali Commission's 2011 List of Distressed Communities for the Interior Region of Alaska[25] (See Figure 3.1).

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[22] Alaska Native Knowledge Network.
[23] ------. "Traditional Values Poster." University of Alaska Fairbanks. http://ankn.uaf.edu/Publications/ (accessed March 7, 2013).
[24] I elaborated on said appeal in chapter 1.
[25] Denali Commission, *Distressed Community Criteria (2011 Update)* (Anchorage, Alaska, 2011).

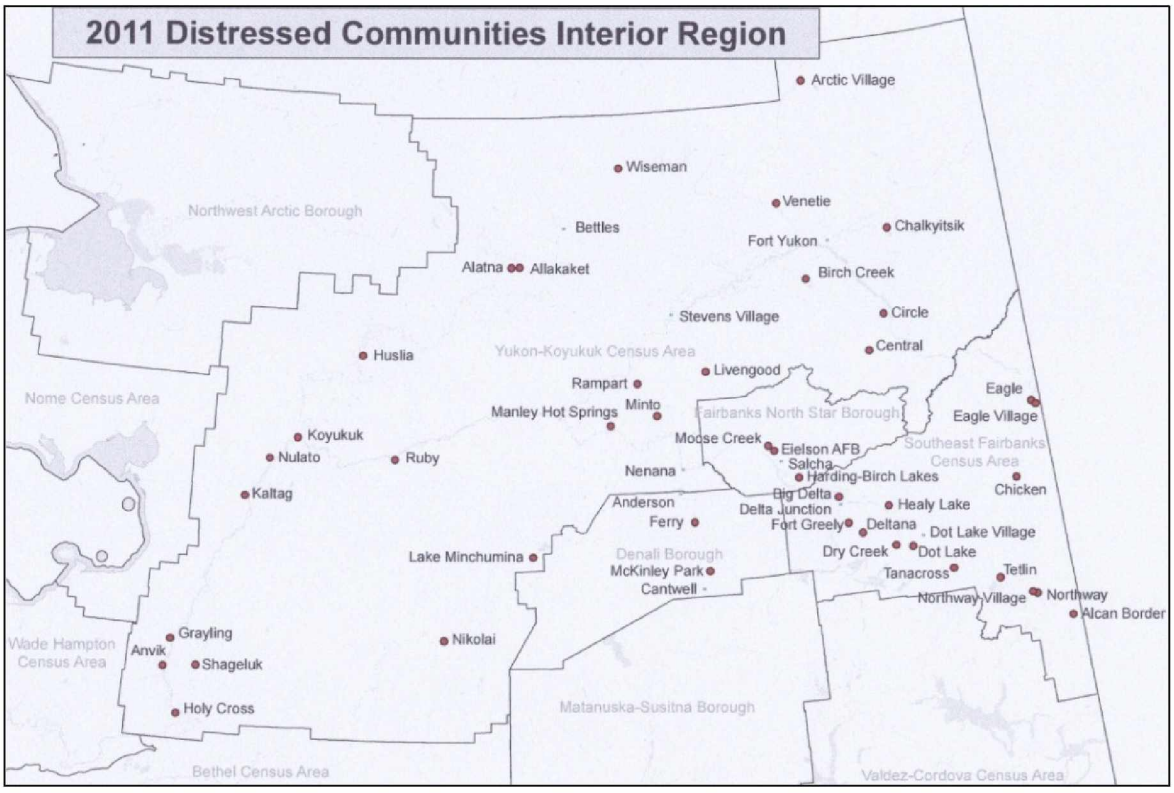

Figure 3.1. 2011 Distressed communities: Interior region of Alaska[26]

Distressed status is determined by comparing average income of a community to full-time minimum wage earnings, the percentage of the population earning more than full-time minimum wage earnings, and a measure of the percentage of the population engaged in year-round wage and salary employment.[27] Thus a very distressed village would be one with a relatively low level of wage employment. Figure 3.1 shows the very distressed communities in Alaska's Interior based on the Denali Commission's criteria.

The unit of analysis in this research was the village respondent. To select participants representing a village, I employed a purposive sampling on the basis of the following inclusion criteria:

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[26] Adapted from ibid., 44.
[27] Ibid., 1.

- long time village residents and/or individuals very familiar with village life,
- residents knowledgeable about local water and sanitation issues,
- residents who play a role that allows them to envision the future welfare of their communities.

Based on these criteria, participants included community residents occupying various positions: tribal leaders, city administrators, superintendents, environmental directors, and water plant operators. Table 5 provides an overview of participating communities and their respondents.

Sample size determination

According to the original grounded theory texts, data collection should continue until there are no new discoveries i.e., "data saturation."[28] However, recent revisions to this directive acknowledge that it is rare that data collection is an exhaustive process and researchers should rely on how well their data are able to create a sufficient theoretical account or "theoretical sufficiency."[29] This revised objective allows interpretive researchers to work upon constructs that emerge from the problem under investigation.[30] For this study, theoretical sufficiency guided recruitment, rather than seeking "data saturation." To understand the social world under study and achieve a convincing explanation, the targeted region under study (Interior Alaska) was represented by collecting samples from each of the subregions within, as explained in the following paragraphs.

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[28] Glaser and Strauss.
[29] Ian Dey, *Grounding grounded theory: Guidelines for qualitative inquiry* (San Diego: Academic Press, 1999), 117.
[30] Díaz Andrade, "Interpretive Research Aiming at Theory Building: Adopting and Adapting the Case Study Design," 48.

Villages under TCC jurisdiction are organized into 6 subregions.[31] Five of these subregions are served by TCC's Office of Environmental Health Department that works with water and sewer projects in villages. This study recruited one participant representing each "distressed" largest and smallest village, in terms of population size, within each TCC subregion. The objective was to collect the varied perspectives that villages of different populations may have regarding the particular challenges and advantages they face in sustaining water and sewer systems. As a result, the sample size was nine villages instead of ten because one of the five subregions served by TCC only had one village listed under the 2011 distressed criteria.

All except one of the participants self-identified as being Alaska Native. For confidentiality purposes and to protect the privacy of study participants and the communities they represent, non-identifying ID numbers are used throughout this thesis to link respondents to their comments e.g., *2L* (See Table 5). TCC subregions, in no particular order, are represented by a numerical prefix. Village size[32] is identified with a letter, with *S* representing the smallest village in the subregion and *L* the largest one in the subregion, according to the 2011 List of Distressed Communities for the Interior region. In the case of the TCC subregion where only one village (with 100 residents) was listed as distressed, I assigned the identifier for smallest village (*5S)* because there was no larger community for contrasting the number of residents.

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[31] Tanana Chiefs Conference. "List of TCC Tribes & Villages." http://www.tananachiefs.org/tribes_villages.shtm (accessed February 15, 2011).

[32] The number of residents specified in Table 5 was established after reviewing the results of the 2010 Census and consulting with interviewees. A few of them noted that the number of residents in their villages decreases during winter months and increases in the summer. One of the reasons to this was that more people come to the village to join their relatives for fish camps in the summer so as to provide labor in exchange for part of the fish catch. In a few cases, data provided by the 2010 Census did not coincide with the number of individuals with full-time residency that interviewees stated.

Table 3.1. Interview respondents: Individual and community characteristics[33]

Identifier	*Interviewee*			*Community*		
	Role in the Community	Gender	Age	Predominant Water Delivery System	Size	Residents
1S	Tribal Administrator	F	54	water hauled from washeteria	small	40
1L	Water Plant Operator	M	63	running water through piped distribution	large	159
2S	Tribal Administrator	M	62	water hauled from washeteria	small	300
2L	Superintendent	M	46	running water through piped distribution	large	625
3S	Environmental Director	F	30	water hauled from washeteria	small	106
3L	Tribal Administrator	M	41	running water through piped distribution	large	175
4S	City Manager	F	44	water hauled from washeteria	small	102
4L	Water Plant Operator	M	60	running water through piped distribution	large	271
5S	City Manager	M	64	running water from individual wells	small	100

Recruiting participants for the purposive sample: Three-stage approach

Stage 1: Identifying potential participants

Alessa and Kliskey[34] propose an agent-based model where the ability of a community to respond successfully to change depends in large part on the composition of agent types in the community. They argue that the social roles that individuals play, specifically, as *initiators*, *facilitators*, or *opportunists* may be powerful determinants of community agency. The use of this model can contribute to our understanding of critical factors that enhance the ability of communities to respond to environmental change.

Following this agent-based model, I sought the advice of staff members at TCC's Office of Environmental Health (OEH) to identify "initiators" and "facilitators" representing the nine

[33] A washeteria is a communal type of facility that provides sinks, flush toilets, showers, washers and dryers, as well as drinking water for hauling. It is also known as a watering point, washhouse or laundromat.

[34] Lillian Alessa and Andrew Kliskey, "The Role of Agent Types in Detecting and Responding to Environmental Change," *Human Organization* 71, no. 1 (2012).

villages targeted in this study. Then, I contacted the village tribal or city council[35] by telephone and informed the person about the study and asked for referrals to potential respondents in that community. In some cases the names given by OEH staff were confirmed. In others, different village representatives were recommended as being more knowledgeable or current in their positions. In such cases, I pursued the newly referred individuals.

Stage 2: Making contact with nominated individuals

Potential respondents were contacted first via fax. The faxes included letters of invitation introducing potential respondents to the study and inviting them to participate in a phone-interview. This invitation also included the letter of support to this study signed by TCC's president Jerry Isaac (Appendix A).

Follow up phone-calls were made to confirm that the potential participant received the fax, to provide more information, and to answer additional questions regarding the study or the interview. Nominated individuals were also offered a free calling card as a token of appreciation. In my view, the value of the calling card ($20) was within the boundaries of a reasonable gift to avoid inappropriately inducing potential respondents to participate. Upon agreeing to take part in the interview, dates and times were set to meet respondents' convenience. Arranging a phone interview with a community representative took me, on average, about five attempts within a follow-up period that ranged from two weeks to six months.

[35] Most Alaska Native villages have both a tribal and a city government acting in the community. The management of water and sewer utilities and infrastructure varies from village to village. In some cases, it is under the responsibility of the tribal government, in others under the administration of the city council.

Stage 3: Pre- and Post-interview: Obtaining consent and showing appreciation to participants

Prior to starting the interviews, I assured all participants that they could withdraw from the interview or the study whenever they wished. I asked for their informed oral consent. After the interviews, I mailed respondents a copy of the informed consent information sheet for their personal records. This script included information regarding their rights as study participants and contact information for any questions that they might have in the future (Appendix B). I also sent the free calling cards to thank them for their time. As a final gesture, to personalize the thank you, I enclosed a picture of me taken during my stay in the Native Village of Nulato.

Data collection instruments and methods

Telephone-interviews were primarily conducted from my office at the University of Alaska Fairbanks, Ernest Gruening Building. In two instances interviews were conducted in person; one in my office, the other at the lobby of a Fairbanks hotel.[36] Semi-structured, standardized interviews were in-depth and qualitative in nature to trigger open ended answers. I chose telephone interviews over face-to-face interviews because I considered them to be more feasible and convenient to participants, as they would not take too much of their time and they might feel less inhibited when answering questions. Telephone interviews had the advantage of including a larger sample of villages for gaining varied perceptions across the Interior region during the timeframe allotted for data collection. Time and costs associated with travel to and from villages would have been prohibitive.

[36] This was to suit the participant's convenience as he was visiting Fairbanks with his wife to attend a training that was taking place at this same hotel.

Interviews

A semi-structured interview guide was developed specifically for this study. Questions and content were based on a review of literature about regional challenges to providing water and sanitation, discussions with experts on local water issues, input from my academic advisors, and feedback from one tribal administrator who pilot-tested and provided constructive feedback about the interview guide.

The interview guide focused on gaining local perspectives on:

- a definition of healthy water,
- a definition of a healthy community,
- a definition of community self-reliance,
- connections between water and sewer service and community self-reliance,
- an understanding of how the public program for water and sewer service works.

I organized the questions to help respondents become situated with the main subject under discussion, starting with fairly simple questions and gradually building up the brainstorming process to prepare them for answering more complex questions. Although I preferred posing the questions in this order, these were participant-driven semi-structured interviews, so I was flexible and followed the natural flow of the conversation. In some cases, this order was not necessary as the preparedness of each respondent to address these issues on the spot varied. For example, participant 2L had overseen water works and water plant operations for many years in his position as superintendent. Therefore, he was able to navigate faster through the interview in comparison to other respondents who, although familiar with local water issues, had not considered access to water and sewer in conjunction with concepts such as self-reliance and healthy communities.

According to respondents' answers, spontaneous follow up and clarification questions were posed to address fully the original question and to elicit fully the respondents' insight as well as enhance the researcher's understanding. In addition, respondents were asked to provide information about themselves (e.g., age, sex, ethnicity, place of birth, occupation, and educational background) and the type of water system they had at home. (For a display of questions and prompts, see interview guide in Appendix C).

As the student researcher, I conducted all the interviews. Their lengths ranged from approximately twenty to eighty minutes, with fifty minutes as the average length. With permission of participants these interviews were digitally audio recorded for subsequent transcription and analysis.

Data management

During data entry and analysis, the equipment for audio-recording with its recorded tracks was stored in a locked office I had been assigned as a teaching assistant at the University of Alaska Fairbanks (UAF). The transcription files were stored on a password-protected computer in my office as well.

Audio recordings for each interview were transcribed verbatim using Microsoft Word by me and the professional transcription services firm "Administrative Plus Support Services" located in Nevada, Texas. I transcribed four of a total of nine interviews. I granted the firm's transcriptionist access to the audio files through a Secure File Share Service provided by the Life Science Informatics center at UAF's Institute of Arctic Biology.

After all interviews were transcribed I proofread the transcripts making additions and corrections for fidelity to the recorded interview. The interview transcriptions became the raw

data for inductive coding. Each transcript was prepared and entered as a text file into NVIVO Version 9.2.81.9 (NVivo9),[37] a qualitative analysis management package which allows researchers to attach codes (called "nodes" in NVivo9 software language) to text segments so that they can be stored, sorted, and queried for major themes across, or within questions, transcripts and samples.

Data analysis

According to John Creswell[38] in qualitative research, data analysis involves collecting open-ended data, based on asking general questions and developing an analysis from the information supplied by participants. Creswell urges researchers to look at qualitative data analysis as flowing steps from the specific to the general and as involving multiple levels of analysis. Creswell introduced Figure 3.2 below to suggest a linear, hierarchical approach building from the bottom to the top, but argued that it was more iterative in practice as the various stages are interrelated and not always visited in the order presented.

I examined data across participants' responses for key themes. In this phase of the analysis, I summarized qualitative data across participants to describe general thematic patterns present. I used elements of grounded theory analysis[39] to offer explanations grounded in the experiences and perceptions of village residents. Per this method, I open-coded and categorized transcribed data from each interview following a process called "constant comparison," a significant characteristic of the grounded theory approach. Constant comparison involves initial coding of the data to capture themes within the transcripts allowing researchers to become

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[37] Copyright © QSR International Pty Ltd. 1999-2011 All rights reserved.
[38] John Creswell, *Research design: qualitative, quantitative, and mixed methods approaches*, 3rd ed. (Los Angeles: Sage Publications, 2009), 184.
[39] Strauss and Corbin, 270.

sensitized to similarities and differences within the data.[40] Identified codes are then compared and used to form core categories that attempt to represent the data. Core categories are given conceptual definitions that move them beyond descriptive tools to analytic units.[41]

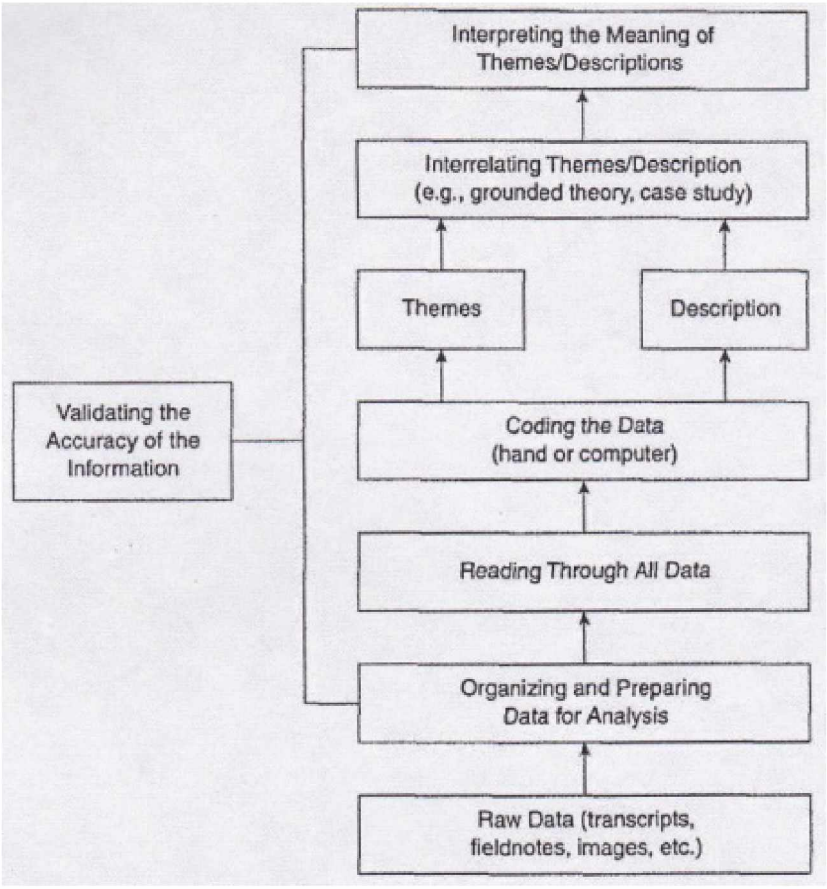

Figure 3.2. Data analysis in qualitative research[42]

I used the constant comparison method to group common concepts within and among interviews into named categories.[43] After reading through the transcripts, I assigned descriptive labels to the data using NVivo 9. During the first phase of my analysis, I looked for and coded

[40] Olivia Southwell and John Fox, "Maternal perceptions of overweight and obesity in children: A grounded theory study," *British Journal of Health Psychology* 16, no. 3 (2011): 628.
[41] Ibid., 631.
[42] Creswell, *Research design: qualitative, quantitative, and mixed methods approaches*, 185.
[43] Strauss and Corbin.

information that specifically pertained to the five main topics addressed during interviews, as I considered the findings would later help me achieve the three research aims that would allow me to answer the overall research question guiding this study.

These labels were then used to create an NVivo codebook that evolved as new labels or codes[44] were added, grouped or nested under or above others. I developed codes for passages within each transcript feeding them into the evolving codebook I was using to code subsequent transcripts systematically. Changes to the coding process were made to reflect the perceptions of the participants. This process continued until each transcript was coded per the most recent codebook.

To enhance the coding process, in the next phase, I coded for other ideas as they seemed relevant to the study and contributed to answering my research question. This included considering participants' unique life circumstances, knowledge, occupation, and general views on the delivery of water and sewer service in his/her own village.

I organized data, including illustrative quotations pertinent to each code within a summary of codes. This summary facilitated the analysis of thematic patterns within and across respondents allowing me to identify thematic units present in the data as they related to the questions of interest in this study.

Generalizability

In a qualitative study, the interpretations made by researchers play a key role as they bring "subjectivity to the fore, backed with quality arguments rather than statistical exactness."[45] Therefore, qualitative research is representative and cannot be generalized. This is an inherent

[44] Recognized as "nodes" by the software language that NVivo9 uses.
[45] Garcia and Quek, 459.

limitation of qualitative study which strives for rich information. For the particular subject under study, I offer a comprehensible and sincere account of the analyzed phenomenon but, with Guba and Lincoln's warning that "no construction is or can be incontrovertibly right [and researchers] must rely on persuasiveness and utility rather than proof in arguing [their] position."[46] The goal of my qualitative inquiry was to reach a discovery-based understanding of the phenomena under study and not to prove a hypothesis through testing and/or falsification. The objective was to achieve that understanding within a purposive sample of community members living in a specific cultural, political, economic and geographic region of Alaska; not to generalize results to all Alaska Natives or American Indians. As such, I did not intend to make broad claims about the statistical representativeness of my findings because they were not based on frequency, but rather in comprehensively incorporating all elements mentioned by participants (e.g. when defining concepts such as "community self-reliance"). The generated findings will suggest testable hypotheses that could later be investigated in a larger population based study. My goal was to offer locally informed ideas to the Native community, government agencies, and service providers regarding variables that could strengthen the sustainability of water and sewer services in rural Alaska.

Enhancing quality

Although five interviews were transcribed by professional services; I proofread all interview transcripts to enhance the reliability of findings. Besides relying on transcriptions for later analysis, I took notes during interviews to capture nuances and non-verbal cues that went beyond verbal communication. In addition, employment of key aspects of the grounded theory

[46] Guba and Lincoln, 108.

methodology such as the constant comparative method helped to ensure that findings remained closely aligned to the data and helped to move the analysis to a higher level of abstraction.[47] Attending an outstanding class on Qualitative Analysis at UAF during the time I was completing the thesis writing process proved to be very beneficial for me as it opened avenues for reflexivity. In particular, sharing assumptions about the data with supervisors and peers allowed me to increase reflexivity and gain additional perspectives during the coding process, with the recognition that any grounded theory analysis is inherently a personal process to some extent.[48]

[47] Juliet Corbin and Anselm Strauss, "Grounded theory research: Procedures, canons and evaluative criteria," *Qualitative Sociology* 13, no. 1 (1990); Roy Suddaby. "From the Editors: What grounded theory is not." Academy of Management Journal. http://journals.aomonline.org/amj/articles/Suddaby2006.pdf (accessed February 27, 2013).
[48] Charmaz.

4. RESEARCH FINDINGS AND DISCUSSION

> *"If funding runs out, it runs out. There is nothing we can do about it [...] If stuff started breaking down we could just probably fix it ourselves. But you've got to work a long time to know how everything works."*
>
> —Water plant operator (17 years in service) for community 1L

Findings from my analysis of the qualitative data collected through interviews are presented in the following sections. Characteristics of each respondent and his or her community are represented through the identifiers listed in Table 5. The exploration of themes addressed by village-based respondents during interviews and the interpretation of other relevant findings are essential to answering the overall research question guiding this study: How does the public program for delivery and operation of water and sewer systems relate to the self-reliance of Alaska Native villages in the Interior region of Alaska?

Self-reliance may be especially relevant during times of rapid change or turbulence when fuel prices, food, and transportation costs have skyrocketed. These critical resources for sustaining village life do not have local substitutions; thus villages are either increasing their dependence on substantial help from outside actors (including funding from agencies) or trying to find resilient and creative ways to provide for themselves by decreasing their reliance on resources that are locally scarce. Therefore conceptualizing "community self-reliance" during the early stages of data collection was critical for exploring the central aims of this study.

As noted in chapter 1, a comprehensive answer to the overarching question was realized by achieving the following three research aims which are addressed in the following sections:

1. Explore concepts of healthy water, well-being and community self-reliance from the perspective of experts currently living in Alaska Native villages;
2. Explore the relationship between the current program for providing water and sanitation services and self-reliance in Alaska Native villages;
3. Build knowledge related to the strengths and limitations of the current public program for delivering water and sanitation services.

Exploring concepts of healthy water, well-being and community self-reliance from the perspective of experts currently living in Alaska Native villages

Healthy water

In response to the question "What do you consider to be healthy water?" research participants expressed various conceptions. Some respondents described healthy water as water that had been treated. According to participant 2L, "it's really unsafe to drink any water that isn't treated." Others stated that healthy water is more accessible when there are piped systems in place that deliver running water to homes. Respondent 4S reported that the best way to stay healthy and not get sick is to clean up and wash hands frequently, she stated, "but not having access to piped systems everywhere makes things such as hygienic practices a little bit harder, not unreasonably harder, but it does make cleanliness more difficult."

Along the same lines, participant 1L noted that a piped system helps people remain significantly healthier because readily accessible water enables people to wash their hands, clothes, etc. This participant acknowledged that natural sources of clean water existed near his village but residents are disinclined to use them because clean tap water is available. It is difficult to install and maintain a piped water infrastructure locally, but once installed, it promotes health:

> If we do it with the systems, you know water will be good, but it will be a lot of work to get it, [to have a pipe infrastructure work in the area]. With the piping system it's a matter of just turning the tap on and off. We've got a lot of little streams and we live on a hill-like area; there are a lot of streams up there [so it's easy for Elders to get creek water] and [our community has] really good clear water, our wells are right in the village, but people don't use them anymore because it's too easy just to turn on the tap instead. [Laughing]

Other participants also said that it was possible to have access to healthy water without engineered systems because water from the creek and river were considered to be good (1S). Respondent 4L, added that his village had used local natural water sources for many years before they built the community's water treatment plant. In his community, water pollution had not been reported lately. Interestingly, this same respondent had previously answered that healthy water was "running water from the tap because it's cleaner water."

Some participants described community perceptions regarding local surface water quality and shared that melted ice or water fetched directly from creeks was still used as drinking water either due to taste preferences or due to its being more highly regarded in terms of water quality. Participant 1L reported that older people go out and harvest ice because they do not like the chemicals in treated water. Despite this statement, this participant also perceived that the rest of the community preferred to use the piped water because "it's too easy just to turn on the tap." Respondent 1S explained why people in her village prefer to drink natural sources but also use engineered water systems:

> They put a well in, but there is a lot of iron in it and they've tried softeners but everybody in the village was raised off of the water out of the creeks and so that's what everybody drinks year round. They go up to

> the laundromat and they haul the water and they use it for dishes, whatever you need water for, but their drinking water comes out of the creek. [They don't boil it, they drink it like that] They don't like the iron coming out of the wells. They don't like the taste of well water; it's not like creek water. [Laughing]

On the opposite side of the spectrum, one participant (3L) dismissed the possibility of having access to healthy water without piped systems, arguing that in his community healthy water was not accessible without a well.

Interestingly, several respondents expressed both views, for and against engineered water systems. On one hand, some individuals consider the river water and mountain stream available in the summer much cleaner. On the other hand, these same respondents stated that treated water is cleaner than that of the river (3S). I hypothesize that this perception varies according to the final use of this resource (water for washing up versus drinking water). As such, multiple perceptions of what is clean or safe water exist, and many depend on the context of water use.

Finally, in one instance, I observed that despite having strong interest in acquiring access to such amenities participant 2S held suspicion that the treated water delivered by engineered systems in recent decades may be causing detrimental health effects. He and his wife emphasized their concern regarding an illness among young village residents that is usually rare in young people; however it was currently occurring in a few communities of the Interior region.

> Before [water systems] we used to drink the water from the river and it never bothered us. Now I'm scared to drink the water from the river because I'll get sick, I figure. They talk about the stuff that's in the water now from the beaver, giardia, and some other stuff that they talk about, you know, and it's scary to think about that. But I always think that I drank this [treated] water for so long that something in me went away, so

> [now] I can't drink [river] water. It's funny. . . . But there has been a high incident of gallstones now. [We never had this problem growing up but] all three of my daughters had it. There are a lot of incidents of young people getting gallstones in Fort Yukon now. And maybe it's because of the treated water we've been drinking for the last 20 years. I'm going to bring it up and talk to the Yukon River Watershed people and see how they can look at it. There must be something there because we've never seen that.

When I asked my closing question as part of the interview protocol "Of all the things we discussed today, what was the most important to you?" the respondent raised the concern that this illness may be linked to consumption of treated water again.

Summary

Some respondents considered water to be safe or healthy if it had been treated. Other participants also noted that systems supplying water to homes through piped distribution encourage healthier habits by improving access to clean water; they said that more people are likely to use water that is readily available delivered to their homes. On the other hand, several perceived "raw" water as found in the natural environment (such as from streams) as safe and better tasting. Some respondents appeared to contradict themselves as they expressed both views. As one of the participants concluded, community views on the definition of safe or healthy water vary widely.

Healthy community or well-being

This theme was introduced through a question asking respondents to share their definition of a happy or healthy community.[1] The rationale for asking this question was to learn whether access to safe drinking water was a component of their definition of community health. Indeed, this was the case for the majority of respondents. Almost every answer touched upon the importance of safe drinking water to a happy and healthy community. In only two cases respondents had to be prompted to describe the role that water played. As a result, their answers also pertained to the fundamental role of water access.

In terms of how water systems impact community well-being or community health, many participants stated that healthy water delivered by water systems was essential for community well-being. This sentiment was expressed by participants who represented a variety of occupations (i.e., water plant operator, tribal administrator and, superintendent, city manager). Some respondents (4L, 4S) identified water security as a primary concern:

> I would say water and sanitation is [our] number one thing and it's always our biggest concern. I mean I can tell you this, every night I go to bed and every day I wake up hoping that we've got running water, hoping that it hasn't frozen up, hoping that the well pump hasn't gone out, hoping that there is not any issue over there because there is [only] one source (4S).

This respondent is a city manager, so it is possible that she is especially cognizant of the state of the water system. She may feel personal and professional responsibility for the well-being of her community members.

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[1] From my discussion with the study participants, I gather that in some villages this concept can be referred to as community wellness or community well-being interchangeably.

The importance of access to engineered water systems seems to have increased as people progressively adopted permanent forms of residence leaving behind dwelling practices typical of traditional nomadic societies. Respondent 3S explained:

> It was once possible to get very clean water [without engineered systems] but now that our way of living in stationary framed houses [has replaced our nomadic way of life] we probably need to have the facility. Once, the clean water would have been readily available [in nature] but the facility is definitely part of the community now. If it was taken away it would cause drastic problems.

The respondent did not specify what problems would ensue, however, washeterias[2] are now part of daily life in rural Alaska and fill many critical functions. Respondent 2S (who helps with washeteria operations) elaborated on their critical roles, particularly in communities where in-home piped water service is not available.

> People depend on it nowadays. It's a place to do their laundry, a place to shower. It opens seven days a week because people want it open seven days a week, even on holidays. If you try to leave it closed one day, they have these radio walkie-talkie things and they'll get on there to [ask around] "Why is the laundromat shut? Does anybody know why the laundromat is shut?" So they depend on it quite a bit. They don't give me a break. [Laughing]

Respondents also connected the concepts of a healthy community with engineered water systems associating "before" and "after" health effects with ease of access to running water. Participant 2L explained this point:

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[2] As a reminder to the reader, a washeteria is a communal type of facility that provides sinks, flush toilets, showers, washers and dryers, as well as drinking water for hauling. It is also known as the watering point, washhouse or laundromat.

> Compared to the past, there are a lot more healthier people than there was before we had the water system . . . . If you don't have running water, you've got to pack your own water and it takes a lot of your time. Somebody in the household will have to do it every day, go get water into the house and take the honey buckets back out and stuff like that . . . Definitely [sustaining water utilities makes] a healthier community. Then your kids wouldn't get so sick and Elders might live a little longer because they wouldn't get as sick. You know, it will be a healthier community.

Running water (indoor plumbing) was considered the most helpful type of water system due to its convenience and the likelihood that people would wash hands more frequently. Respondent 4S cast the following scenario:

> Let's just say for example that I'm in my dry cabin and I'm going to cook chicken for dinner. So I'm going to open up a chicken. The normal thing that we would do is turn around and wash our hands, right? O.K. you can do that, sure . . . but here, you have got to make sure that you have potable water available in storage . . . which has been hauled to your home. But let's say it's forty below zero, you know? . . . Are you really going? I mean, truly, if you think about it, are you really going to bundle up and go wash your hands whether it's one block or two blocks?

In a similar vein, respondent 1L living in a community where the majority of residents have access to indoor running water through piped distribution carried throughout the village reported that before there was running water there used to be a lot of illness in his village. It was too inconvenient to haul water so people rationed their water and did not wash often enough. Now they simply turn the tap on for washing. "Before they didn't get rid of the germs because it was too much hassle to do it, but now you just do it…[There used to be a lot of] sores and all of that. Now people keep a lot cleaner (1L)." It is interesting to note that despite using different types of

water systems in their communities, these two respondents (4S, 1L) expressed similar views that engineered systems providing indoor running water are most helpful for community health or well-being.

Along with access to safe water, affordable, up-to-date systems also play a significant role in community well-being. Respondents explained that as money becomes scarcer people are increasingly unable to afford luxuries like piped indoor water (5S).

Respondent 1S lives in a village that does not have in-home running water service. Instead, residents haul treated water from the local washeteria. They prefer creek water over treated water for drinking purposes. The respondent stated that hygiene was important to community health and explained how community members did their part to stay clean despite not having water service at home:

> Everybody is really pretty good about [staying] pretty clean. Their dishes need a little bit of bleach, they know. Everybody pretty much knows [how to stay clean]. And when they use the bathroom, they wash their hands. Everybody is very clean like that around here. Everybody would love running water and indoor bathroom, but we don't have it, so we just make do.

The small size of the community (approximately 40 residents) most likely made it difficult to afford an indoor water delivery system. However, the participant did not seem frustrated. She explained that the majority of their population was comprised of Elders, and their welfare was the local priority. Most of the community's resources and efforts focused on providing their Elders with a pleasant experience during their late years and helping them pass their cultural legacy to younger residents.

Summary

All respondents, independent of occupation and type of water delivery system available in their communities described access to safe drinking water as an integral part of community health and well-being. They provided different explanations as to why they hold this view. Water infrastructure, such as washeterias, has become a part of daily life. Access to water at home not only makes a community healthier because "kids wouldn't get so sick," it can also provide comfort and improve life quality so that "Elders might live a little longer." For improving quality of life, indoor plumbing seems to be perceived as the most helpful health-promoting component of a water system. However, one participant remarked that considering the financial distress remote villages face, not just any type of infrastructure would provide benefits. These need to be "affordable and up to date systems."

Although there was general consensus that access to water and sanitation infrastructure was essential to community health and well-being, it is unlikely that one particular type of delivery or system will provide the most benefits across all communities. Important considerations include the following: How many gallons of water would be readily accessible at home or after each trip to the community's central watering point, whether or not access should be located in the home, affordability, ease of operation and maintenance, and system reliability.

It should be noted that while virtually all respondents identified access to clean water as an essential element to a community's being healthy, a couple of study participants were prompted during the interview to consider this water and health association. Had they been asked "what is the most important factor related to community well-being?" perhaps not all would have placed access to safe drinking water at the top of the list. This again bears policy implications for

effective service delivery as the local priorities of communities may determine their level of engagement and/or human agency to sustain their water infrastructure and utilities.

Community self-reliance

The tribal value of self-reliance has recently gained prominence in discussions about community development in Alaska. Participants in this study were asked to define what "community self-reliance" means to them. The purpose in asking this question was to explore how access to healthy water or water systems might play a role in what they consider to be a self-reliant community. Interestingly, respondents had difficulty defining what has been described as an important Native value.[3]

Through my analysis of participants' responses, I identified three traits that helped define or contributed to their perceptions of a self-reliant community. These included:

- Sustaining a local economy to provide the services and the employment needed at the village level
- Effective local governance
- Preservation of Native values.

These traits and the responses associated to them are analyzed below.

Sustaining a local economy to provide services and employment

Respondent 5S (employed by his city government), explained that self-reliance does not arise frequently as a topic of discussion amongst city employees. Still, he ventured to define it in terms of employment.

[3] Alaska Native Knowledge Network, "Athabascan Cultural Values".

> Not here at the city government [folks don't talk about self-reliance] so much. But [self-reliance] probably has to do with jobs and the government. I think that's what you're talking about. It probably has lots to do with agriculture [and food provision]. Self-reliance to me is saying that people can get jobs and they don't have to think about the outside world for finding whatever they need. I imagine that on the tribal level they are probably considering [self-reliance] more than on the city level.

In his last comment the participant is referring to the independent position of tribes. Powers of municipal governments are delegated by the State, whereas tribal powers are not. Therefore the aims of city and tribal governments differ. City powers have already been explicitly described and delimited by the state, while there is a whole body of federal Indian law aimed at defining tribes' own type of government and re-establishing their semi-sovereign status within the territory of the United States. The Indian Self-Determination Act of 1975 discussed in chapter 2 is an example of such legal instruments. Considering the aforementioned arguments, it is understandable that self-reliance would not fall under the aims of the local city government where this study participant lives.

Respondent 4L shared that the local provision of basic public services is also critical to self-reliance, so that people do not have to leave the village to access services:

> Self-reliance would be if we had people who would do all the services: power, health and welfare, recreation. If we handled all that stuff [locally] and had people employed, maintaining, and operating all these services, then we would tend to be self-reliant. We can't be [isolated or completely independent and] all of that because we need outside products such as gas, heating oil and groceries.

Renouncing the concept of self-reliance in an ancient or traditional sense, this respondent clearly dismissed the idea that self-reliance means living in isolation and only practicing traditional ways.

He discussed how his community benefits from exchange and engagement with the "outside" world.

Job creation was viewed by participants as a key factor in self-reliance, particularly in terms of enticing local economic activity and avoiding out-migration. Respondents stressed the importance of starting a variety of businesses, keeping people employed and giving people a role to play in the community. Having meaningful work to occupy people is important (1L). This may be interpreted as a need to develop a local economy and workforce not only for financial gain but also for social well-being.

Effective local governance

The role of local governance was highlighted with arguments that the ability to perform administrative duties locally is also essential to achieving community self-reliance (4L). Effective fulfillment of administrative duties was described as being important, because if one person fails to perform his or her job, a chain reaction can make everything else fail.

> You have got to be self-reliant in administrative duties. You can't have other people trying to figure out what you [as a community] need, or how to do it and how to get it. It wouldn't be good, if people didn't do their administrative work here in [the community], be it tribal or city stuff. That's where things start (4L).

Respondents suggested that community planning and civic engagement, as well as support from inside and outside the community are important in opening up avenues for self-reliance (3S). Additionally, a healthy relationship and good coordination between the tribal and city government at the village level were identified as essential to enhancing local governance. Participant 5S (who works for the local city government) explained that sometimes the tribal government doesn't work well with the city government:

> I'm trying, you know? I think it's very important that they do. But yeah, people are starting to realize that they need to go together now. So I'm looking forward to one of these days when we can work together. More powers to the people, you know? Because who is impacted is the people. Government is more like offices [working] for the people. That is how I see it.

Preservation of Native values

Several respondents expressed the opinion that continuing the practice of Native values and traditions (such as collective sharing and subsistence activities) strengthens community self-reliance. Respondent 2S stated that sharing and collaboration among community members would increase community self-reliance. Yet, cohesiveness was seen as lacking in some communities, thus challenging their ability to achieve self-reliance:

> We're now in this world where everything costs something. You have to pay for this, for that, have this to get that… We've kind of pulled apart. When they did the Alaska land claims[4] that's what happened. It divided us. "This is mine. That's yours." That's how we think now. I always tell [community members] that "if a group of you were taken and dropped off someplace out there where there was no money or anything, you guys would really work together to survive because that's what our ancestors did." But [that tradition] doesn't even exist anymore. At public meetings I say, "We're a community, we should always work together," but after the meetings, people go about their same way. This sense of "community" is fading. I see it. [Pause] But if there is a death or a tragedy in the community, we all pull together. I joke sometimes and say, "gee, somebody should die," or we should have a tragedy or something so the community pulls together. It's funny. [Laughing]

[4] The respondent was referring to the Alaska Native Claims Settlement Act (ANCSA) of 1971.

According to participants, there are repercussions of the "fading" sense of community. The connection between community and self-reliance is such that a decline in one of the two can render the other impossible. Alaska Natives have managed to survive and thrive for millennia by relying on each other as part of a band or group. It is interesting to note that this practice, looking out for the community as a whole rather than pursuing self-interests is contrary to Euro-American values of personal pursuit of happiness and achievements based on individual talents.

Respondents also spoke of the importance of tradition, culturally appropriate foods and quality of life when defining a self-reliant community. According to respondent 3S, to be self-reliant, a community must be self-sufficient "all across the board," in preserving tradition and culture, and in achieving Native values. This participant added that responsible care of the environment is also relevant, because that is where a lot of Native culture and food originates. Furthermore, she argued that villages should continue to seek improvement in health and well-being, but they must also maintain traditional values related to self-sufficiency despite inundation with western values and advances in technology:

> As an educator of mine said once, "just because we use the technology of the West, we don't have to submit to that ideology." We can remain with our traditional culture and self-sufficiency despite the changes in technology.

This comment expands on the idea that being a self-reliant community does not imply the rejection of modern technologies or practices that may improve quality of life, but that in adopting or adjusting to new ways and technology Alaska Natives should not cast off their identities or traditional values. In the words of Alaska Native scholar, Edna Ahgeak MacLean,

"values remain constant but means of achieving them change."[5] Similarly, the participant's remarks also suggest an interest in exploring ways in which public programs (e.g. water and sanitation delivery) can be designed and delivered without compromising long-standing values, such as that of self-reliance.

Participants elaborated on how continuing the practice of traditional activities (such as subsistence hunting and fishing) can be a source of strength in communities. Not only can it enhance self-reliance by providing food security, but also by enhancing a sense of meaning and purpose in life for Alaska Native people who live in remote villages:

> The Indians down south hardly hunt anymore because there are so many people there. In Alaska we still have room to hunt and fish which feeds us quite a bit during the winter. That's self-reliance to me. Living like that was the best time of my life. I really felt that I belonged. Serving in Vietnam really messed up my mind. I drank and did a lot of drugs. When I finally came to, I went out to the woods and that was my healing, living out there doing all of that subsistence stuff. Every day I was doing something to survive, to keep myself alive. I had to hunt, get my water, set my animal trap, all just to eat. That really brought me back. Plus, I was by myself; I was in my own little world. To me, that was the best time of my life, living my traditional way, the way life is supposed to be (1L).

Perceptions of self-reliance seemed to be conditioned not only by the context in which individuals live, but also by personal characteristics such as age and gender. The older participant quoted above belonged to a generation whose Native traditions were more widely practiced due

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[5] Alaska Department of Education. Alaska State Advisory Council for Bilingual Education, *Distant Voices, Shared Dreams: The 14th Annual Alaska Bilingual/Multicultural Education Conference, February 3-5, 1988* (Alaska Department of Education, 1988), 13.

to less exposure to western culture. Currently, younger generations of Alaska Natives find themselves navigating and trying to find a balance between the two worlds.[6]

Summary

Defining community self-reliance was not an easy task for participants. Study participants defined self-reliance in various ways, the meaning certainly was not self-evident. Responses suggested that at least for these individuals, three key factors contributed to community self-reliance: sustaining a local economy with wage labor, effective local governance and preservation of Native values. Based on the nature of these three elements, it appears that attaining self-reliance requires a balance or complement between two value systems:

- Western or Euro-American values (e.g., development of a cash economy to support critical services at the local level and for personal fulfillment) and,
- Native or Athabascan values (e.g., preserve cultural traits such as a strong sense of community cohesion and the practice of traditional activities such as subsistence hunting, fishing and trapping).

[6] Ellen Lopez et al., "Forging a new legacy of trust in research with Alaska Native college students using CBPR," *International Journal of Circumpolar Health* 71, no. 18475 (2012): 4; Inna Rivkin et al., "Value of Community Partnership for Understanding Stress and Coping in Rural Yup'ik Communities: The CANHR Study," *Journal of Health Disparities Research and Practice* 4, no. 3 (2011): 2-3.

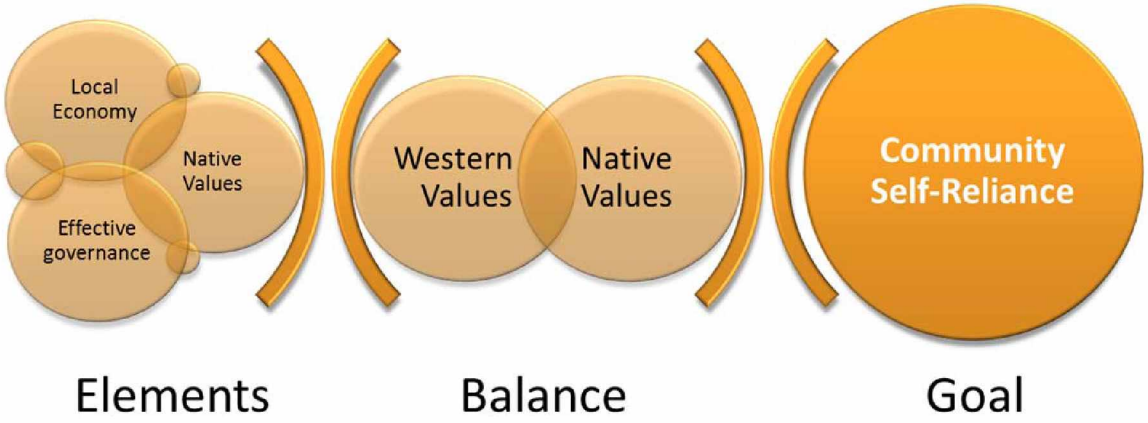

Figure 4.1. The balance that enhances community self-reliance

Considering that respondents expressed a complement of western and traditional values in describing self-sufficiency, it is noteworthy that there is a risk that economic activities to sustain the cash income source to afford expensive amenities (such as water utilities) could trump key traditional non-cash activities needed to sustain critical livelihoods (such as subsistence hunting or fishing for local food security). In achieving the balance between the two value systems, developing administrative capacity for local governance could play a key role. If working well together, local governments (both city and tribal) could successfully engage community members in creating and pursuing one shared vision of improved well-being for the community as a whole, both value systems would be affirmed.

The interplay between community self-reliance and access to healthy water

Respondents found it difficult to make a direct link between community self-reliance and access to safe water (or water infrastructure enabling access to this service). This is an interesting finding because it suggests that, even among some participants who were referred because of

their knowledge of water issues, there was a lack of awareness of the human and economic resources needed to sustain water utilities in small, remote villages. This undertaking requires having sufficient local financial, technological and administrative capacity to support continuous service delivery with less reliance on outside actors or resources.

For participants, the link between access to healthy water and community self-reliance was not as evident as the immediate connection between access to healthy water and community well-being. Only a few respondents reported that access to clean water played an important role in community self-reliance. One respondent noted the likelihood that such systems would enhance employment opportunities. Others drew a connection between a water and sewer system and the community's attractiveness to residents, visitors and business investment, all of which relates to self-reliance. Participant 4S explained how water service could bring benefits to the local economy:

> Because the community then would move for economic development putting in an industry that creates jobs, one or more. But you have a difficult time, first in getting people to want to move into a community without running water or sewer and second, in having them stay in. Tourists and even people traveling around don't want to come and stay in areas without running water or sewer. There are all sorts of economic development opportunities that this community is missing out on because we don't have running water or sewer.

According to this view such economic development would lead to community self-reliance and water and sewer service would be a stepping stone to this economic development.

Another participant remarked that self-reliance means not only having access to clean water, but having appropriate infrastructure for delivery. This is particularly challenging when constant repairs are needed for systems poorly designed for use in rural Alaska. As participant 3S

expressed, "[The community] has to spend a lot of energy and resources to maintain those systems."

Another respondent also stressed access to clear, fresh water as an indicator of self-reliance. According to participant 1L, "clean water,"[7] found in the natural environment, was important to self-reliance. He defined a self-reliant community as one where people do not have to rely on the cash economy for life's necessities. They could subsist on what nature provides: "We can just live off of the land, and the water is so clean that we can just drink it. We're one of the very few people in this world that [would make it] if all the stores closed." (1L)
This comment is a reminder that preserving the health of the natural environment is also critical to maintaining traditional subsistence activities that enhance the ability to achieve a healthy balance between self-and other reliance in the community, as opposed to creating dependence on resources that originate outside the village.

Two participants (1S and 5S) felt that they could not say whether a program for water and sewer service would increase or decrease self-reliance. Their villages had 100 or fewer residents and relied on individual wells (5S) and a washeteria (1S) respectively. These do not require the same degree of funding, regulation, and procedures set out by the public program for village water and sanitation services. Thus they might not have recognized the increased responsibility associated with more complex engineered systems.

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[7] This participant who as a water plant operator is presumably knowledgeable about local water quality expressed that his community had no water pollution problems such as surface water contamination. However, it is unclear whether this is a fact as village water quality reports were not reviewed for this study due to time limitations.

Summary

Only a few respondents identified an intersection between healthy water and community self-reliance. Responses received from those participants indicate that they believe:

- Access to water amenities might entice economic development, for example by encouraging temporary or permanent migration into a village;
- Costly and poorly designed water infrastructures (highly fuel dependent systems and systems difficult to operate and maintain in rural Alaska) can impede self-reliance as the community must "spend a lot of energy and resources to maintain those systems;"
- Preserving local supply and quality of water (as found in the natural environment) might reduce dependence on outside technical and financial assistance for harvesting or treating the local water. This is not to say that the participant expressed that engineered systems are not needed. Instead, he implied that there are other considerations in regard to water resources found in the natural environment besides those concerning water resources delivered through engineered systems in the built environment. In his view, taking such considerations into account would allow people to have access to a healthy *natural* water supply "even if all stores closed."

Exploring the relationship between the current program for providing water and sanitation services and self-reliance in Alaska Native villages

To address this research aim, I analyzed responses of the nine participants to learn how maintaining water and sewer systems impacts self-reliance in terms of the public program for funding and regulation of water systems. Participants identified a lack of public financial

assistance for operation and maintenance as one of the greatest challenges of having engineered water systems in villages. Participant 2S explained that simply providing funding for acquiring infrastructure creates problems if operation and maintenance are not funded as well:

> It's a funny thing, how the government is always willing to come and put expensive infrastructure in, but it will never give you money to maintain it; *you* have to. If you wanted a system in there, you have to figure out how your people are going to pay for it and keep it going. [Without a cash economy] that's bad. That's the problem they've created for us.

Despite the challenges associated with sustaining such expensive utilities in villages, several participants said that the public program does not necessarily have to impede self-reliance. Participants deemed local capacity essential to self-reliance: "You can still be self-sufficient in having all of this stuff and be self-sufficient and maintain it yourself, you don't have to worry about anybody else coming to fix your drain or something." [Laughing] (2L) Federal and state effort to develop local capacities is a wise investment because training programs are beneficial to communities. Respondent 1L noted that residents in his village are quite resourceful; pointing out how important it is to develop the local capacity necessary for a sustained operation of water systems gradually:

> If stuff started breaking down we could just probably build or fix it ourselves. But you've got to work a long time to know how everything works. [In my community] there are a lot of people who know a lot of stuff too. They don't work in the water plant but they know about different things.

This same respondent suggested that proactively reaching out for more resources can develop local capacity, as doing so reduces dependence on a single source of funding. According to him villages were becoming dependent on outside support to keep their water systems running,

but he was not sure whether having a water system increased or decreased self-reliance. His community had received a $1 million water system but no funds for maintaining it. The money collected from user fees in the village is insufficient to cover all the expenses of water utilities. However, he reported that they were learning how to apply for funding grants from different sources just to keep their system running. In this sense, maintaining water infrastructure can be both a challenge and an opportunity for developing capacity, such as grant writing locally.

Having the resources or financial, technological and administrative capacity to manage the acquired water systems successfully was described by participants as essential to being able to sustain the utilities gradually on their own. As long as these resources and capacities are available within villages, respondents did not view dependence on outside support as a threat to community self-reliance.

Participant 3S related how his community was increasing its self-reliance by reducing its dependence on fossil fuel:

> [My community] now is making drastic efforts to become self-reliant, self-sufficient. Currently, we have a biomass project.[8] We are trying to hook up biomass heating and water systems to the washeteria and to a number of tribal buildings, and that will help us become more self-reliant, more self-sufficient because we will not rely on fuel nearly as much. The [heating fuel] system will still be there to heat and to run the facilities but we are able to offload some of that [cost]. So, hopefully through new, alternative energy fuel sources villages can become self-sufficient. I think that this [biomass heating] is a good project and practice. I think this can definitely get us right in the right path for self-reliance, self-sufficiency.

[8] An example of a biomass project would be burning willows or fish waste to generate power in the form of electricity or heat.

Other responses[9] suggested that the public water system could *foster* self-reliance. Respondent 3L explained his perspective of how government support for water and sewer systems is helping the community to increase self-sufficiency. It does so particularly by encouraging the community to plan for the possibility that the funding will eventually run out. According to this view, "[the public program] just helps [them] while getting on [their] way to being self-sufficient" (3L).

Similarly, respondent 4L thought that rather than creating dependence, the water system is gradually developing capacities, and one day the village will become self-reliant. "The public program is helping. We get the training from outside. Once we are trained and know how to do things on our own, we can see whether we can do it."

The participant from the largest community (2L, 625 residents) rejected the idea that the community will always have to rely on external support, suggesting that eventually the community should be able to afford running the utility on its own:

> No, [water systems are not increasing dependence on outside support]. This community can't get any outside support. It's all got to be done here. If the community can't afford it they will have to shut it down. Well, not necessarily, all of the funding has got to be taken out of the user fees to run it. That's how they figure what your bill will be every month to run the system.

This statement reveals having a large community size (thus a greater customer base) for water utilities works to their advantage in terms of sustaining services through local resources.

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[9] These include responses from participants who held that the public water system program does not necessarily need to decrease self-reliance.

This suggests that for-profit water utilities[10] would be more viable in communities where there is a large enough customer base with sufficient cash income.

When asked what makes a self-reliant community, respondent 3S had noted that villages cannot prosper if they must devote [excessive amounts of] economic and human resources to maintain poorly designed or overly complex systems. Participant 1L, an experienced water plant operator, pointed out the need for infrastructure that corresponds with the technological capacity available in the village, particularly that of water plant operators:

> The only thing I think I'm having trouble with there is that [new electrical] panel [at the water plant] . . . you know? It's a bunch of electrical stuff and I don't know about that kind of stuff. They put in $1 million worth of stuff and I don't know how to repair it. . . . We told each other all we really need is an on and off switch and here they put this $1 million dollar [system].

This comment highlights the problem that sometimes the infrastructure delivered in the village does not correspond with the capacity of the local water plant operator. There is a need for finding appropriate technology or "community fit" when delivering water systems in villages.

In summary, respondents' comments suggest that avoiding deterioration of community self-reliance is not simply a matter of avoiding water utilities. Preventing deterioration of self-reliance requires avoiding poorly designed and high maintenance systems that a village cannot afford without outside support. Water systems must promote self-reliant ways of affording and sustaining access to safe water locally by operating with technologies and policies that villages can afford and sustain.

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[10] In some villages, particularly small ones, residents pay very little or nothing for having water access. Some village governments provide partial or full subsidies for this service.

Perceptions of the role of organizations in the policy process

I asked the respondents: "How does the process develop whenever a village wants to acquire, repair or upgrade water systems?" Drawing from their responses, I gathered their perceptions on what organization or agency does what or how they think the process develops. I also took note of how they rated the program performance for water and sanitation in villages. I deemed the exploration of these comments relevant to the research aim of exploring the relationship between the current program for providing water and sanitation services and self-reliance in Alaska Native villages. My findings are discussed in the following sections.

Respondents expressed a variety of conceptions about the roles of tribal, state, and federal agencies in providing funding for water systems. Despite their having been referred to me as being among the most knowledgeable in their communities about the local water service, several respondents were not certain of how the process develops outside a village (the roles that federal and state agencies play). The fact that villages are somewhat arbitrarily (from a village perspective) assigned to either the state engineer via the Village Safe Water program or the Tanana Chiefs Conference engineer can make the process confusing. Survey responses suggested widespread confusion about funding streams. Participants' answers did not suggest a common understanding of the roles and responsibilities of each organization or agency. In some cases, participants described their inability to keep up with the changing roles of key organizations in this process, as one participant noted:

> They've got some engineers over there that are always on call at Tanana Chiefs but now they're shifting over to Anchorage like with [the ADEC[11] Program] Village Safe Water, I think. We're doing a lot of business with them that we haven't been doing before. That might be because of

[11] Alaska Department of Environmental Conservation.

> funding or, I don't know. But, when I used to call up, I used to call Fairbanks. Now I call up Anchorage (1L).

Perceptions about who was the "go-to organization" varied across participants. While a few respondents thought that the regional non-profit tribal corporation, Tanana Chiefs Conference (TCC), manages the monies that villages receive from the federal and state government, others thought it was the Alaska Native Tribal Health Consortium (ANTHC) that managed the funding streams.[12] As participant 2L responded, "Well it would be ANTHC. They'll call me and then I'll call our project manager and he'll see if he can get a grant."

One participant named water plant operator of the year multiple times by TCC provided the most accurate description.

> TCC helps a lot with training, consulting, remote maintenance worker visits, and Village Safe Water helps with making upgrades and repairs. Village Safe Water is the one I put my proposals to and then they get the ball rolling (4L).

Two participants did not know how the infrastructure acquisition process developed or who the key actors for obtaining funding would be. This might be because their small communities did not have complex water infrastructure (other than a communal washeteria or private wells for each household). Communities that solely have a washeteria do not require as much interaction with agencies for funding and regulation compliance.

> We no longer send monthly water samples from the water plant. I'm not sure how it works but somebody will contact us. . . . I'm not sure when they will get to our village. Our population is so small we would probably be on the bottom of their list (1S).

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[12] This was inconsistent with the fact that I had been informed that all communities I had sought participation from worked with the Office of Environmental Health at Tanana Chiefs Conference.

This respondent's last remark is consistent with the agencies' focus on water and sanitation projects that will maximize health impact, as explained in chapter 2. Projects that serve a greater population are more likely to be funded. A knowledgeable technical expert with a tribal health organization identified this as one of the disadvantages that Interior villages face with the current funding mechanism used by the state government. A great number of villages with not many residents are concentrated in the Interior region under TCC representation. The scoring mechanism for awarding funds prioritizes projects that will deliver a higher health impact. Thus, in the race for funds, communities with fewer residents are not as competitive as those with a larger population. Given this reality innovations including smaller scale systems that are less expensive to operate and maintain should be encouraged.

In summary, most participants were unsure of who the key actors and agencies in the process for obtaining village water and sewer systems were. Respondents seemed more familiar with people or individuals in government roles than the complex maze of water governance itself. However, they did not seem concerned about not knowing these details. This incomplete understanding of funding streams and where help can be obtained to access funding may have important implications for the evolution of the public program and community self-reliance. Village actors can more effectively identify strengths and limitations of the policy process if they can pin point which agencies are responsible for what aspect of the process; without this knowledge it is less likely that they can provide feedback to policy makers or administrators that could improve program delivery. Such an impasse could lead to frustration and less than optimal service in villages. Similarly, regulators and service providers may feel frustration[13] that these programs are not being implemented as effectively as they could be, as Sarcone reports. Perhaps

[13] Sarcone, 350, 355-357.

communication barriers between federal and state agencies on the one side and village administrators and operators on the other prevents the two fronts from understanding each other well. This is another example of the challenges that cross-scale governance poses to the delivery of a public service. In this case users of water and sanitation systems located in remote areas live in an environment from which public officials at other scales of governance are removed and are thus unfamiliar.

Rating of public program performance by village respondents

Toward the end of the interviews and after discussing strengths and weaknesses of the current program for public delivery of water and sewer service, I asked participants to provide an overall rating of the public program. With the exception of participants from communities with little to no interaction with the government program providing this service,[14] the participants rated the program's performance as working rather well. One participant reported that the program was indeed working and that it would continue to work "as long as villages followed the state of Alaska's regulations" (4L). On the other hand, respondents also said there was "room for improvement" and a long way to go. The following commentary from participant 2S illustrates this view:

> I mean they made a lot of mistakes putting stuff in, you know?[15] My community is a perfect example. When I lived in [a different village], they were working on water and sewer and I imagine they're probably still working on it too [smiling]. But I remember they even had insulated

[14] This refers to communities where a washeteria is the community-shared form of water infrastructure serving as watering point for village residents to collect water from, take showers and do laundry; in which case most financial support is provided by TCC.
[15] The respondent refers to the construction of the water infrastructure.

> pipe and they were putting it in. It's crazy. It's just trial and error, trial and error.

In the community this participant referenced, the permafrost layer is pervasive or continuous. Placing insulated water pipelines in this frozen layer can cause the sinking of the ground level by way of rising underground temperatures and melting permafrost sections, thus damaging above-ground infrastructure that relies on this surface for foundation. On the other hand, the local temperatures can reach extremely low levels during winter so, merely insulating above ground pipes would not be useful. The high costs associated with heating these types of infrastructure are noteworthy. It is in view of these circumstances that participant 2S expressed his frustration. Consequently, there are still many lessons to be learned by agencies and village actors in delivering access to water and sewer service in villages.

Surprisingly, participant 3S who was weary and critical of poorly designed and overly expensive infrastructure shared the following positive assessment:

> Well, there are a lot of good things, at least we have regular access to water; there is laundromat facilities or shower facilities and things like that. You know, when the system does work, it does provide those services. Almost half of our community is on a sewer haul system and I know that people really enjoy being able to have that system in their homes *when* it is running.

Despite being critical of the program, I interpreted this respondent's overall positive rating as reflective of the appreciation of the work that agencies and tribal organizations do in trying to deliver water and sewer service to all villages.

During informal discussions with agency employees at a conference in Juneau on water issues, one attendee (an ADEC official who asked not to be identified) said that there is a "lack of

leadership on the part of villages" to prevent or solve problems related to water availability and quality even when preventative programs are offered at no cost to villages. On the other hand, this agency employee said that senior officials rarely travel out to the villages. If they go, he said, they only stay a few hours, so they are not truly familiar with the daily living situation of locals and how infrastructure should be fitted. Furthermore, with a tone of frustration, he suggested that higher level agency employees have not understood the challenging task faced by lower-level officials who directly interact with the villages. The lack of communication and understanding this official identified commonly arises in cases of cross-scale governance where access to a resource or service is directly affected by the performance of actors at multiple levels of government. This miscommunication must be addressed to enhance the provision of water and other services to villages (e.g., technological innovation, financial and administrative assistance, and technical support).

Without understanding how the water projects are managed at the various scales of government and/or with tribal agencies, village level actors do not know what they can do to improve the experience at the local level. This may lead to a sense of futility. Instead they may steer their focus and use their resources to address other priorities in the village.

The "good" ratings that the program received from most respondents, along with the sentiment of appreciation expressed for the work agencies do, might suggest opportunities for improvements in service delivery and strengthening of community capacity.

Before I decided to pursue this issue through academic research, I conducted informal discussions with water experts and service providers. In the course of these discussions, the perception that village residents feel a sense of entitlement arose. However, I did not perceive a sense of entitlement among respondents. None of the participants made comments suggesting

that it was "only fair" that all villages had access to modern piped water and sewer systems similar to those in Alaska's urban areas.

I sensed appreciation on the part of respondents for being asked their thoughts on the subject. More than once when I contacted village councils and potential respondents to seek their participation in this study, I received remarks such as "I'm glad someone is looking into this" or "Yes, this is such an important issue." These and other comments indicate that agencies and communities could benefit from agencies' taking a more communicative and collaborative approach with village actors.

During the informal discussions I held with water experts and service providers, I was informed that there is a lack of understanding of all that is involved in receiving water and sewer delivery in villages. It was suggested that there is not a generalized awareness of the implications of acquiring, operating and managing water systems. Such lack of awareness, also evidenced in the majority of responses I received, could help explain a perceived lack of initiative, involvement or engagement in sustaining the systems, in some cases, which may appear to be a sense of entitlement to agency officials.

A sense of entitlement may be *inferred* by actors in government agencies when communication is not optimal and actors do not have full access to information, when neither side understands the other's capacities and challenges, and when village actors are not aware of the bureaucracy behind funding mechanisms (potentially leading them to experience frustration when funding is not forthcoming). As explained in chapter 2, it is up to the assigned engineer to understand the complex bureaucratic process behind funding and designing water infrastructure because the agency does not to want to overwhelm village capacity with such responsibilities. Despite the good intentions behind that measure, it is possible that this paternalistic approach is

not entirely beneficial to strengthening village capacity. It is plausible that the policy distances village actors from equally complex institutional requirements and processes at other scales of governance.

In suggesting a sense of entitlement in villages, professionals in administrative positions pointed to the fact that the Native youth in the Interior region passed a resolution demanding the delivery of this service to all villages within the next three years.[16] The good intentions behind the youths' resolution are clear. However, it is also clear that they, as part of the customer base of this service in villages, are not fully aware of the long-standing challenges to reaching this goal. Younger village residents are the future customers who will pay for water utilities and possibly operate and manage the systems. As such they should have a better idea of the implications of such expectations, the current challenges to delivering this service and the economic base required to operate and sustain it. Again, a more communicative approach on the part of public agencies and service providers could improve awareness and enhance agency efforts to deliver this service more effectively.

Building knowledge related to the strengths and limitations of the current public program for delivering water and sanitation systems

Participants were encouraged to share their views regarding positive and negative aspects of the public program supporting the delivery of water and sewer service in their communities. As presented below, participants addressed various topics, including capacity and training opportunities, communication and coordination, appreciation, regulations and alternative energy,

[16] Tanana Chiefs Conference received a resolution signed by its youth in 2011, demanding that this organization work toward the goal of delivering running water indoors to all villages in the region within a three year time frame.

design issues and local input, the pay for water plant operators, the lack of a holistic approach applied in service delivery, and an inequitable funding process.

Among the benefits of having water and sewer systems, respondents identified the development of technological capacity to maintain the systems. Some participants (1L, 4S, 4L) praised the contribution that Remote Maintenance Workers (RMW)[17] make by preparing operators to maintain or repair systems. In fact, the number of RMW villages with certified operators has increased from 40 in FY 92 to 94 in FY 12.[18] RMWs are seen as smart, and familiar with geography, culture and village life. On the other hand, the RMW program is still challenged by the limited number of staff available to provide services. As one participant explained, "They're trying to cover a lot of villages with very little personnel so they make it infrequently out there" (4S). One participant implied that on-site troubleshooting is helpful whereas other forms of assistance, such as providing advice over the phone, is often less helpful (4L).

Respondents viewed training opportunities to prepare applicants for the water operator certification exam and trainings to update current operators are viewed as positive. Once the local operator's capacity has been developed, a village can maintain water infrastructure without outside funds for repairs. In the words of the respondent for community 1L, "Once operators know how to do it, it's kind of simple. It's not that complicated." This remark highlights the key role that water plant operators play in securing sustained access to safe water in villages. One capable and committed operator can be invaluable, not only in acquiring funding for addressing repairs but also in saving time and energies in navigating through the administrative process.

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[17] The Remote Maintenance Worker Program provides circuit riders who troubleshoot and help develop the capacity of rural Alaskans to operate local water and sewer facilities, while safeguarding state and federal capital investments in utility infrastructure.

[18] Alaska Department of Environmental Conservation. "Remote Maintenance Worker Program Annual Report State Fiscal Year 2012." http://dec.alaska.gov/water/rmw/pdfs/FY12%20RMW%20Annual%20Report.pdf.

However, training programs with outdated repetitive content were identified as not very useful. As one participant mentioned, "they're the same training, the same subjects and everything [but technology] is always changing [and operators need] to keep up" (2L).

Respondents viewed the training and employment of a local workforce for water projects in villages positively (2L). Good communication and coordination between service providers, funding agencies (e.g. Alaska Native Tribal Health Consortium), and village councils seem to play a key role in ensuring that communities have well-trained operators. Participants also considered the incorporation of local knowledge into feasibility studies conducted before building water projects a strength.

Although they identified challenges, respondents indicated overall appreciation for having access to water and sewer service at home. Respondent 2L said, "It has made populations healthier than in the past." Another explained, "Despite having dilapidated facilities, having water that is tested, treated and meeting safety regulations is absolutely a positive thing" (4S).

Respondents viewed regulations protecting water quality from contaminants positively. Additionally, they expressed support for initiatives to move toward reducing fuel consumption for water infrastructure because the cost of fuel is "so very high in villages" (1L). Some participants identified heat recovery and biomass combustion systems as helpful strategies.

On the other hand, respondents pointed out that a community's ability to maintain the infrastructure also depends on the systems' design (capacity) to work in rural Alaska. Incapacity leads to frequent, costly, and time consuming repairs. Moreover, some respondents reported that local knowledge often times is disregarded. Respondents viewed incorporating local input (and context) as essential for the construction of water systems. Participant 2S shared an anecdote from the 1980s that illustrated the failure of agency policies to respond to local conditions. A

piped water system was being built in his community. He asked the superintendent "Is this going to work?"

> Superintendent: *"No"*
> Participant 2S: *"How come you're putting it in then?"*
> Superintendent: *"I'm supposed to"*

That same season the respondent saw the system failing and needing repairs. Although efforts to work collaboratively on the design of such projects have since improved, there is still a long way to go, he said. This is a sentiment shared by both state officials and tribal leaders working on these types of projects. There remain cultural and communication barriers that result in frustration and leave both village residents and public officials or service providers feeling that attempts to overcome these barriers have failed.

Another respondent was critical of people being sent to build water systems with limited knowledge of the local weather conditions. She felt that such "experts" act like they know it all and village residents know nothing. She explained, "Village people are supposed to keep their mouths shut and listen to the foreman; when they start telling the foreman what they should do to keep water pipes warmer, the foreman is not listening" (1S). This anecdote suggests that actors in this village have experienced frustration because the local input they offered was dismissed.

Another weakness in the system identified by respondents is that few financial incentives are in place to retain capable operators. "They[19] don't pay them enough. They only pay them $8.00 an hour and they've got to be there for only 2 hours," explained one respondent (2L). This is especially true of villages with fewer residents, because the local government does not have the means to offer benefits. As one participant explained:

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[19] The respondent was referring himself to the city government running the utility. It is important to remember that the administration of water utilities varies from village to village as it can be the responsibility of the city government or of the tribal government.

> There are not a lot of hours for this position. In really small communities there is no real benefit with the position. When you're working for the government you have health insurance, retirement and things like that, but these small communities cannot afford to provide for their workforce. Wages are lower than other positions available in the community so when they can move on to another position they leave the small government positions for positions with higher pay and benefits (4S).

Another respondent noted that salaries have declined: "The state used to subsidize the salary of water plant operators in the past but they cut all of that out, no idea why" (2L). One of the respondents, reported that in 17 years the local water plant operator had only received one raise and "they're always adding duties [to the position, like taking care of the dump] but they're not raising [the] pay" (1L).

Two of the research participants were water treatment plant operators for their communities. Each had held the operator position for many years. I met with each in person. Through our discussions, I discovered that what held them to the job was not the pay they earned for their services, but also commitment to their community and maintaining their Native way of life. However, it was also clear that they did not feel their community acknowledged the contribution they made in their roles as water plant operators. This lack of appreciation of both the essential role of skilled operators and the other costs associated with maintaining a complex water and sewer systems may explain why respondents (when asked whether this service increased or decreased self-reliance) did not immediately link acquiring modern expensive infrastructure along with the associated responsibilities with increasing dependence on external government funding.

In regard to public policy, a lack of a holistic approach on the part of funding agencies and regulators for water and sanitation projects potentially works against the goal of securing the provision of water projects. Just as there is funding support for acquiring engineered systems but no support for their operation and maintenance, there is funding for acquiring water supply infrastructure but none for solid waste (human excreta) disposal, as this participant explained:

> A recent report says that over 6,000 homes in Alaska lack running water so . . . how do they dispose the waste water from the house, from their kitchens, bathrooms, honey buckets? Where is that disposal going? There is no funding at all in Alaska to help a village deal with the disposal of the waste from the non-running water homes. I haven't been able to find it, if you find that, please let me know. For example, if your house is in a sewer-haul system and for some reason it breaks down, you're back onto the old honey bucket system, with no running water, and you don't have a way to efficiently dispose of that. This becomes an environmental issue right away and there is no funding in Alaska that will help villages with that. . . .So, now imagine we bought all this brand new system or we had a couple million dollars pumped into the water facility, none of that funding can be used to dispose or enhance the old system of honey bucket disposal. Now, who is going to dispose of all those outhouses no longer being used? Perhaps new outhouses should be built in case the overall system shuts down leaving us with no way of properly disposing waste. Or else, we need to keep certain outhouses going. . . . Something like this is definitely an issue with funding and policy that needs to be addressed (3S).

When consulted about this matter, public officials confirmed that there is indeed very, very little funding for solid waste management available in the state. The majority of funding goes to water and "grey water" sewer projects. According to EPA official Dennis Wagner, this is

so, not because funding cannot be used for solid waste, but because the agency considers the need for water and sewer improvements greater than the funding available. Additionally, the health impact resulting from water and sewer improvements is regarded as much more substantial than that from improvements to solid waste facilities. "With $1 million, we can do a lot more in a community to affect health risks and benefits by providing better water and sewer facilities than we can on a solid waste site," he explained. He acknowledged that this is difficult for many communities that have had running water and sewer for over twenty years but are still faced with open-dump-like situations and are unable to access funding for solid waste projects.

The only way funding shortages for solid waste disposal might change is for a federal or state agency to dedicate funds for solid waste improvements. National politics and cross-scale governance[20] play interesting roles here. Wagner reported that solid waste received much attention in the 1970s in the lower forty-eight states when there was generous public funding to address solid waste issues for both tribal and non-tribal communities. As those needs were addressed, funding decreased. In terms of infrastructure development Alaska is two generations off, he said. While there was sufficient support for solid waste elsewhere, Alaska had just started working on providing basic water and sewer. "So we missed the boat on that funding source; solid waste would have to become a national issue again in order to see that source of funding grow; until that happens, there's not going to be a lot of money for solid waste in Alaska," Wagner reported.

Like the water cycle itself, access to safe water is a circular process. Participant 3S stressed that access to safe water and proper sanitation cannot be sustained if solid waste issues

[20] This refers to the interplay between actors and institutions at different levels of government.

are not addressed. The specter of ground contamination[21] renders this need urgent. The lack of funding for solid waste projects indicates a piecemeal approach and illustrates the Denali Commission's finding that there is no "sustainability" definition shared by all agencies concerning the efficiency and ideal outcomes of basic services delivered in villages.[22] Moreover, the lack of a shared vision between villages and agencies makes funding and construction of water and sanitation projects inequitable. The lacking common goal between federal, state and tribal administrations contributes to a lack of communication and inefficiency between the different scales of governments (cross-governance), ultimately compromising access to water and sanitation services in Alaska Native villages.

Finally, the research raised questions about the fairness of the current funding mechanisms, although I posed no such questions directly. The scoring rubric prioritizes the maximization of health impacts. Therefore large communities can out-compete those with fewer residents in the race for funds. This concern was shared by respondents living in villages and working at tribal organizations. Participant 4S shared her frustration with the inability to secure funds for infrastructure in her community due to its reduced number of residents (102).

> They'll say all sorts of things. They'll say, "The community is too small to invest that much money." So my response back to that is, "So you just put a dollar figure on my forehead? Tell me what it is because when you're telling me that the cost per person is too expensive, what price tag are we putting on our people as far as basic health and safety and sanitation goes?" Because obviously somebody believes there is a price

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[21] Edda Mutter and William Schnabel, "Assessment of rural Alaska solid waste leachate," in *American Water Resources Association – Alaska Section Annual Conference, Juneau, March 5-7, 2012*, ed. Anna Liljedahl (Juneau: 2012), 36; Molly Chambers et al., "Transport of fecal bacteria by boots and vehicle tires in a rural Alaskan community," *Journal of Environmental Management* 90, no. 2 (2009): 961.
[22] Denali Commission, *Sustainable Rural Communities: A report by the Denali Commission in coordination with Federal Partners*, 69.

> on it. . . . We're focusing too much money on the major [urban] areas. But you'll lose your major areas without your outer lying areas supporting because all of the supplies, from groceries to medications, clothes, gear, you know, snow machines, everything, comes from the major areas out here into the villages. Their economy is dependent on these villages.

Limitations of this thesis research

This exploratory research was carefully prepared, undertaken in a systematic way, achieved its aims and resulted in robust findings. However, there were some unavoidable limitations. The findings that emerged from this study share the same limitations as those inherent to the qualitative methodology, and in-depth interview studies, in general. This study was conducted with distressed communities located in the Interior region of Alaska, and involved interviews with a small number of village respondents who were referred by others because they were knowledgeable about the public water program in their villages, and thus rich sources of information. As such, caution should be applied when attempting to generalize or transfer findings beyond this group of respondents (and their communities). In contrast to developing firm conclusions about the problem under study, the aim of this research was to gain in-depth insight from knowledge experts, and to generate ideas and hypotheses for future studies that could inform the design of policies for the public water program. Additional qualitative and quantitative studies with respondents from villages both labeled and not labeled as distressed communities are warranted.

I am limited in my ability to disassociate myself from biases and preconceptions regardless of my attempt to identify and bracket them. This limitation was countered by gaining

multiple perspectives and triangulation of data. Although village respondents were the primary sources of expertise, data collection was not one-sided. Village experience was represented through a variety of key occupations. Additionally, the findings and interpretations also represent perspectives of agency and community leaders, expert academics, key government officials and staff at tribal organizations. Triangulation of data was achieved through data-checking discussions with three advisors on my thesis committee. During these discussions I shared preliminary findings. Besides receiving their individual feedback, we met several times between March 2012 and March 2013 to engage in group discussion to double-check my findings and analysis and address other relevant details (e.g., the decision to avoid placing undue weight on the perspectives that might express only one participant's views). Other methods included the use of identifiers to track which study participant said what. Identifiers also helped categorize interesting and relevant comments. To avoid making blanket generalizations, identifiers were used to track frequency, consistency, and disagreement among participants' responses. In terms of reflexivity to my own potential biases, it is clear that careful listening and rigorous analysis (grounded in the data and not preconceived frameworks) were vital, as several findings refuted what I initially expected.

The study was also subject to logistical limitations, including difficulties in building trust with participants over the phone. Technical difficulties during phone communications included background noise, time lag, and echo. On several occasions, there was a time lag between my asking an interview question, the participant hearing the question, and my hearing the participant's response. At times the pauses caused me to repeat myself, or assume that the participant was confused or had not understood the question. At times it was clear that the annoying lag and my repetitiveness caused discomfort in my interviewees and slightly extended

or shortened interview lengths. Further, while trying to reduce confusion, I sometimes reworded repeated questions, using different but similar terms to those developed in my interview guide (e.g., healthy water versus clean or safe water, community health versus community well-being, or water systems versus piped systems). I am not sure to what extent the use of alternative terminology affected responses from village informants. Shortly after encountering this limitation I started faxing participants an outline of the interview questions. I hoped this would help them prepare beforehand and decrease the time spent in discussing background information during the interview.

Although being a student allowed me to present myself as a neutral party, building trust with participants over the phone was not easy. The two instances when I met with the interviewees in Fairbanks evidenced the great advantage of in person interviews over phone interviews. This was an anticipated limitation, however; therefore in my initial communications I enclosed a letter of support to this study signed by the president of the regional tribal non-profit, Jerry Isaac, who knew me personally and approved the scope and goals of this study. The purpose of the letter was to describe the purpose of this study, introduce me as the student researcher and encourage village participation.

Due to the lack of comparable studies, substantial time was invested in the operationalization of key concepts (e.g., healthy water, healthy community and community self-reliance) grounded on the data collected, limiting time to further analyze data that seemed out of scope but perhaps important. Future studies can benefit from this initial attempt to operationalize key concepts and focus more resources on analyzing other relevant data.

Having time constraints and only nine respondents limited my ability to generate a conceptual framework to situate the provisioning of village water and sanitation services within a

cross-scale governance approach. Although some findings of this study may be more explicit than exploratory, the potential for theory development within the broader field of the role of infrastructure in self-reliance in rural Alaska is yet to be fully realized.

Strengths of this project include the use of rich interview data as the basis for analysis and the identification of a new research frontier. It is important to note that policymakers and service providers involved in the delivery of water and sanitation face great responsibilities constrained by roles that mandate results-driven or goals-driven tasks; they have little time to explore or analyze the actions and perspectives of the customers they aim to provide with the service. This study offers valuable insight into the workings of the public water program generated by end-users, feedback that is otherwise difficult to gather (by service providers).

Finally, this is the first study on the role of community self-reliance in the delivery of water and sanitation service. This first data reveals the potential of a new research frontier in which the analysis of human dimensions can have practical applications for an improved service of water and sanitation delivery in rural Alaska.

5. CONCLUSION

"We can remain with our traditional culture and self-sufficiency despite the changes in technology."
—Environmental Director (30 years old)
for community with 106 residents

What began as a quest to discover the key to providing access to safe drinking water in rural Alaska resulted in identification of multiple barriers to the provision of water and sewer utilities that extend far beyond the obvious financial impediments. In conducting background research, I became interested in the concept of self-reliance and its relation to water systems. This was in response to Alaska Native leaders' encouragement of academic research focused on community concerns such as strengthening self-reliance at the village level. However, a clear understanding of this Alaska Native value was needed prior to developing projects to strengthen community self-reliance. Therefore, I decided to focus this study on village level experiences and expectations regarding water utilities in addition to holding discussions with knowledge experts in key administrative agency positions and regional tribal organizations.

Varied perceptions of healthy water: Native culture is not static

A key finding has been that perceptions of "healthy water" vary widely. Some consider healthy water to be treated water and others would prefer to drink water directly from sources found in the natural environment such as creeks. Moreover, other respondents appeared to contradict themselves as they expressed both views.

At first sight, the fact that different people in this study have different views may not seem very interesting or remarkable. However, conflicting understandings among village

residents suggests that government policies will have to be much more flexible to meet the diverse conditions and expectations in the far-flung villages of rural Alaska.

Furthermore, inconsistent or contradictory responses where participants appeared to prefer treated water at one point but natural water at another point may be an indication that this perception varied according to the final use of this resource (water for doing dishes versus drinking water), which again bears policy implications. The plausibility of this explanation should be addressed in further studies.

That village residents can support both definitions of safe water also challenges the argument that as Native communities increasingly adopt the dominant social paradigm associated with Western cultures (e.g., utilities delivering indoor running water) modern infrastructure will distance people from the natural resource and thereby from traditional culture while increasing their attraction to convenience and recreational values.[1]

Some semi-urban residents around the city of Fairbanks live the "dry" cabin lifestyle with no indoor plumbing. A few of them voluntarily choose to live without water amenities. However, the findings from this research suggest that residents of rural villages are eager for the convenience of piped water. Although they have a strong respect for nature and live in a rural, remote context still practicing traditional subsistence activities, they seem to be very interested in enjoying modern amenities that make life comfortable. As one participant expressed, "[Native people] can remain with our traditional culture and self-sufficiency despite the changes in technology." In this sense, Native values remain intact; what have changed are the methods to pursue or express them.[2] This thought refutes romanticized ideals and outsiders' perceptions of

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[1] Alessa et al., "Forgetting Freshwater: Technology, Values, and Distancing in Remote Arctic Communities," 254.
[2] Alaska Department of Education. Alaska State Advisory Council for Bilingual Education, 13.

monolithic Native culture, a value system or lifestyle that does not evolve with time. The suggestion that indigenous peoples prefer to remain in isolation preserving their local resources and ancient traditions while altogether rejecting modern life in a Western sense is misinformed at best.

According to participants' responses, access to safe water and sanitation is a critical component of well-being for various reasons. For example, as the quotation below illustrates, water facilities have become part of daily life especially in villages without piped water service. In such villages, the washeteria is:

> A place to do their laundry, a place to shower. . . . It opens seven days a week because people want it open seven days a week, even on holidays. If you try to leave it closed one day, they have these radio walkie-talkie things and they'll get on there to [ask around] "Why is the laundromat shut? Does anybody know why the laundromat is shut?" So they depend on it quite a bit. They don't give me a break. [Laughing]

Access to in-home water not only enhances community health because "kids wouldn't get so sick," it can also provide comfort and improve life quality so that "Elders might live a little longer." However, as one participant remarked, engineered systems are not likely to make a positive difference unless they are "affordable and up to date systems."

Most participants deemed improved water service a local priority, with the exception of one participant from a small size community with 40 residents, where the welfare of their Elders was more important than attempting to acquire modern infrastructure for indoor running water. As this community was in its majority comprised of Elders and there was a preference for drinking and preparing meals with untreated "natural" water, I speculate that there may be a generational divide when it comes to perceptions and priorities concerning safe water.

Community self-reliance: achieving balance during times of rapid change

After analyzing how study participants defined self-reliance for their communities, I observed that there are fundamental differences in how the participants perceive self-reliance. Their perspectives vary in terms of their relationships with the natural environment versus the built or engineered environment. Their responses suggest that a healthy degree of self-reliance can be reached through a balance or complement between two value systems: Native and Western cultural norms. Athabascan values nurture cultural traits such as a strong sense of community cohesion and the practice of traditional subsistence activities e.g., hunting, fishing, trapping. Euro-American values may enhance the development of a cash economy needed to support critical services at the local level and to enhance personal fulfillment. The ongoing trade-offs between traditional and modern Western practices may help explain why I observed participants having difficulty defining self-reliance; self-reliance is currently a nebulous concept. Activities to earn cash income to support, for example, water and sewer utilities, reduce the time available for practicing traditional subsistence activities. Moreover, purchasing supplies and equipment needed to pursue subsistence activities requires cash income. This is noteworthy because subsistence activities are critical to the sustenance of rural residents given the remote context in which they live and the difficulty and expense in acquiring store-bought goods.

In achieving a balance between western and traditional values and practices, administrative capacity for local governance plays a key role because village actors in these roles have the potential to guide community members into creating and working together toward a shared vision of improved well-being for the community as a whole. Self-reliance is a continuum, not an end goal. Nor is access to water and sanitation the ultimate determinant of self-reliance. However, sustaining the physical and social infrastructure to secure access to this service is a

piece of the puzzle that, however small, provides opportunities to strengthen capacities needed for reaching balance in Native and Western ways of living.

The interplay between community self-reliance and access to water and sanitation

When I began interviewing individuals knowledgeable about water systems in their villages, I expected to find that having water systems would decrease self-reliance in villages. This expectation was based on previous research by others suggesting that because water systems are so expensive and difficult to maintain, residents from rural, small villages, would become dependent on outside support for their water systems. Other studies had also suggested that having water systems could lead to Alaska Natives being less knowledgeable about their local ecosystems and thus less self-reliant. However, I found that sustaining rural water and sanitation utilities in the Alaska Native villages profiled in this study may represent a challenge but also an opportunity to build local village capacity (as opposed to vulnerability and dependence on outside funding).

Although it cannot be stated from this study that having a public water program either increases or decreases the capacity of the profiled communities to gradually self-sustain their water utilities, it was interesting to receive more nuanced answers than simply "yes, it decreases self-reliance" or "no, it does not." Having access to water and sanitation was not an attribute participants immediately associated with community self-reliance. However, when prodded to specifically consider whether the public water program increases or decreases self-reliance, respondents generally said that public water programs do not necessarily have to decrease self-reliance if they represent a technological match to the capacity available locally.

One of the most common responses was that of frustration regarding the lack of consideration of local knowledge when designing water systems. As a result, water systems have not always been designed to fit the local ecological conditions as well as human resource capacities. Therefore, considerations to assess said match included incorporating local feedback for designing infrastructure that is locally affordable, less fuel consuming, as well as easy to operate and maintain—the holy grail of utilities.

Of the nine communities profiled in this study, the largest (with over 600 residents) seemed to be the only one positioned to rely on themselves more than on "the government" to secure the service in the near future. It appears that for the remaining eight smaller communities, the set of aforementioned conditions must be met before the public program can be provided without substantial government support.

I assert that the delivery of water and sanitation infrastructure that is expensive and difficult to operate, the lack of financial assistance to sustain the systems once they are acquired by villages, the inability to fund projects for solid waste disposal, and the very few professional and financial incentives for water plant operators to remain in the position are variables that render the public water program unsustainable for villages with fewer residents located in the Interior of Alaska because, these impediments challenge the ability of said villages to work toward gradually sustaining the service in the long term.

Unawareness of acquisition process and communication barriers

By looking at institutional and social factors such as the policy process involved in funding and acquiring water infrastructure, the political economic context of villages, and the perceptions of residents regarding the public water program in their villages, I argue that the fact

that many Alaska Native villages are still underdeveloped in terms of water and sanitation services may derive more from a misfit of policies and technological mismatch than insufficient funds at the village level or with agencies at the state and federal levels. This is important because agency concerns are currently focused on the drop in the funding stream.

While some service providers perceive that there is a sense of entitlement to water services and lack of involvement (or leadership) to sustain the systems on the part of villages, I argue that there is a lack of awareness and communication barriers between public agencies funding the infrastructure and regulating the service on the one side and village residents on the other. That participants had difficulties establishing a link between community self-reliance and access to safe water and sanitation (or water infrastructure enabling access to these services) suggests a lack of awareness of the extent of human and economic resources needed as well as commitments associated with acquiring and sustaining this service in small, remote villages. Similarly, responses to my inquiries suggested that the study participants did not seem to have a good understanding of the process for acquiring infrastructure (Figure 5.1). This lack of understanding has the potential to increase communication barriers, which in turn could be lead to perceptions of a lack of involvement, interest or initiative on the part of villages, as discussed in chapter 4. In this sense, political vows to "put the honey bucket in the museum"[3] are not realistic and only help deepen the barrier to communication between urban regulators and rural residents, because such promises may lead rural residents to believe service delivery is a relatively easy task to fulfill (and raises expectations of being served), making agency employees appear to be incompetent or unjust "gate keepers" of the service.

[3] Thomas and Enge.

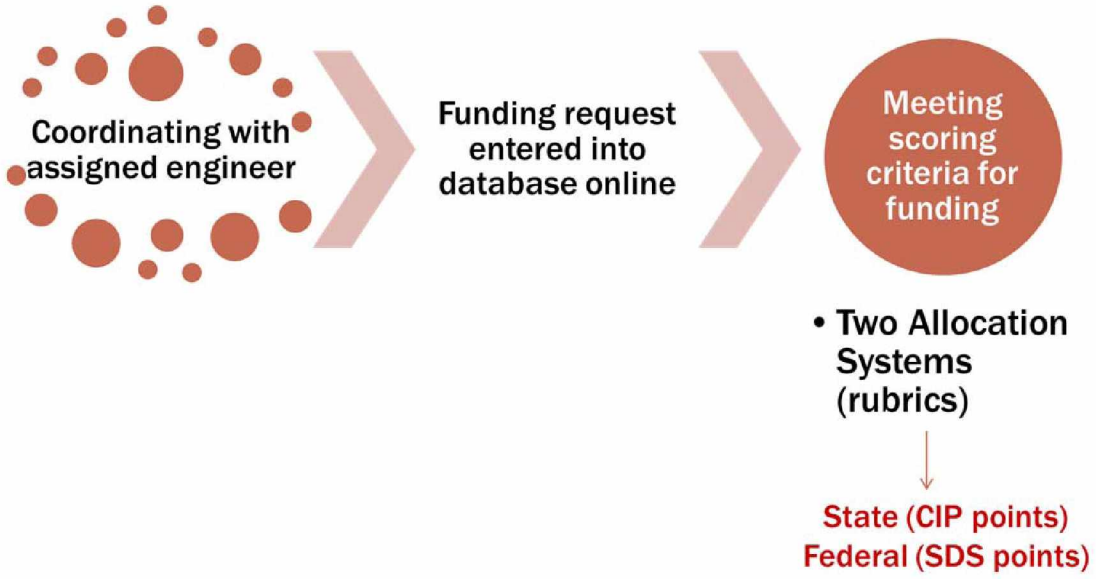

Figure 5.1. Process for acquiring or replacing water and sewer systems in Alaska Native villages

It is unclear whether the practical yet arguably paternalistic measure of assigning engineers to navigate the funding bureaucracy *for* the villages is without drawbacks. It is worth noting that the position of an assigned engineer requires much public relations work, which is not typically required for engineers' training in school. It is yet to be determined what role this approach plays in enabling the flow of knowledge into and out of villages, bridging communication barriers, and strengthening village capacity.

Finally, the inability to secure access to water and sanitation services in Alaska Native villages may not only be a matter of providing or developing financial and technological capacity in villages. I discern that funding agencies, service providers, and regulators will continue to invest substantial resources in providing services that likely will be unsustainable in some villages, if the providers do not understand challenges posed by social, cultural and institutional factors influencing the provisioning of this service. The exploration of these dimensions may be

critical to understanding broader issues of service sustainability. Agencies may find this human dimensions strategy surprisingly useful for developing initiatives that complement their current efforts for designing more effective ways of delivering this service.

Policy implications and recommendations

The lack of partial subsidization of costs for operation and maintenance of water systems as well as solid waste projects should be addressed. Partial subsidization would likely help sustain water and sewer systems. Given the challenges of rural regions' low representation in the state legislature I suggest that the Native youth in villages of the Interior region lobby for an official discussion of this issue in the state legislature. This suggestion is based on the youth's expressed interest in having improved access to water and sanitation services as evidenced in their pronouncement on the issue to their regional tribal organization, the Tanana Chiefs Conference.

Participants' responses showed overall consensus that access to safe water is essential to community well-being, although the concept is admittedly nebulous. However, it must be acknowledged that I had to prod some respondents to consider the link between safe water and well-being. Therefore, I speculate that their primary definition of community well-being would not necessarily encompass access to safe water through a piped system. This may be interpreted variously, but it is clear to me that the policy implication of this ambivalence is that if communities do not prioritize sustaining water infrastructure, they may in fact fail to sustain their water utilities.

The question remains as to how the multi-agency committee for project review and selection accommodates funding for the bulk of smaller villages concentrated in Interior Alaska. The current scoring mechanism prioritizes water and sanitation projects that maximize health

benefits. This criterion grants rural hub villages with more residents and thus potentially larger customer bases more points in the competition for funds. This funding approach has the indirect effect of encouraging migration to larger communities. Institutionalizing a funding system that indirectly promotes migration to rural hubs raises the question of whether the government is undermining, rather than sustaining, infrastructures and communities with its favoring of larger communities.

Communication barriers between agencies and communities must be addressed. It would be in the interest of actors providing water services across scales of governance to grant access to outreach programs with long term goals of educating utility users. An emphasis on younger users may be beneficial as it may spark interest in becoming engineers or operators of water and sanitation infrastructure. Having familiarity with the village setting is an asset; these potential engineers could devise innovative technologies for rural sub-arctic locations. This is a critical need, as the existing options for water infrastructure development seem unsuited for many of the villages profiled in this study.

Current technologies are mainly provided by the mainstream market for water infrastructure, not by a market or vendors specialized in technology suitable for northern villages. Additionally, it is improbable that there is one particular type of water system that works best for all communities in Alaska. Attempts to explore simplified small-scale technological innovations for affordable and easy-to-operate systems are needed.

Entrepreneurs in partnership with communities, Alaska Native organizations, academics, and multidisciplinary college student cohorts (i.e. engineering, communications, social scientists, economists, etc.) could combine resources to propose designed systems suitable for the rural context. It is especially important to involve targeted end-users (e.g. Native youth living in

villages) in the design process. Fostering such human agency would help utility users take ownership of the technology. Designing infrastructure freed of planned obsolescence that takes advantage of local skills and capacities[4] may be particularly helpful.

Providing training opportunities is a wise investment on the part of service providers. Besides those existing for developing capacity to administer utilities and operating systems, training in the application process for accessing funds to acquire infrastructure may be beneficial. In fact, instead of introducing this subject independently, it could be incorporated into already existing training programs. One approach would be to examine how governance works by helping partners to become familiarized with a social network map of people involved in service delivery both from community side and government side. Doing so would raise awareness of how difficult this task is for both sides, especially as they are located in different places. The dynamics of service provisioning can be affected by the interplay between regulations and institutions at multiple levels of government. Perhaps introducing the process from a cross-scale governance perspective can assist in conveying how daunting accessing support actually is.

Operators of water and sanitation infrastructure play a key role in sustaining service delivery. Their contribution must be stressed among service providers and village residents. Their role needs appropriate financial and social compensation on the part of both agencies and their own communities. Social rewards can complement the positive impact that currently existing awards deliver (e.g. TCC's operator of the year award). Awareness raising field trips that are part of educational programs like learning math in a cultural context[5] are suggested as ways of

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[4] Steven Johnson, 2010. "Where good ideas come from," *TED Ideas worth spreading*, http://www.youtube.com/watch?v=0af00UcTO-c (accessed November 09, 2012).

[5] University of Alaska Fairbanks. School of Education. "Math in a Cultural Context: Lessons Learned from Yup'ik Eskimo Elders Project." http://www.uaf.edu/mcc/ (accessed March 3, 2013); Alaska Center for Energy and Power. "Alaska Wind For Schools Program: KidWind Design Challenge." University of Alaska

acknowledging and elevating the key role that operators play in villages. In terms of water plant operators who are capable of doing their job, but seem unable to pass the certification test, I suggest changing the evaluation format to a practicum instead of a test.

Last but not least, regarding public officials' concerns over the suitability of the assessment tool currently used to measure the local capacity of villages competing for government funds; I recommend the development of a metric of local capacity informed by social scientists and using such metric to develop training programs for addressing identified gaps in capacity. All of these recommendations, which have been developed through interpretations and analysis of the responses of local participants, relate to human dimensions of the provision of water service in rural Alaska. It is the human dimensions of the provision of water utilities that largely have been overlooked in the funding mechanisms and other current policies.

Suggestions for further research

A phenomenological study approach to understanding the relationships between actors in the policy process may be useful to explore what is the role and implications of [mis]communication and cultural differences among these actors.

In some communities of the Interior region, a value is placed on fresh stream water because of tradition and custom. "City water" simply cannot compete with the fresh taste of clear stream water. However, water operators may be able to use off-the-shelf water quality testing kits to sample local sources of freshwater for contaminants to ensure that fresh water is also healthy water. Studies are needed to determine whether local perceptions of raw "natural" water as clean water are accurate in each context. Along the same lines, it would be beneficial to conduct studies

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Fairbanks. http://www.uaf.edu/acep/alaska-wind-diesel-applic/wind-for-schools/kidwind-design-challenge/ (accessed March 10, 2013).

that help determine the appropriateness of risk assessment tools used locally for improving drinking water safety.[6]

It is unclear how the public program and agencies respond to the fact that not all residents of rural Alaska define "clean water" or "safe water" as treated water. Considering the Interior youth's pronouncement on access to modern water amenities, it appears as though they would likely define "safe water" as "treated water." Analyzing youth perceptions was out of the scope of this study. Therefore it would useful to address this question in future investigations in order to assess policy outcomes. In the same vein, it is necessary to determine whether water utility users in villages define water as safe according to the purpose or final use of said water. Elaborating on and testing this hypothesis can better inform the design of suitable technological innovations that are cost-effective for entrepreneurs, villages, and government agencies funding the infrastructure.

Native youth living in villages are the future customer base of this service. Therefore learning about their perceptions and expectations for this basic service would be useful to explore ways in which the program could accommodate future expectations and maximize benefits resulting from service delivery. Their engagement in the subject also plays an important role in sustaining access to this service in remote villages.

Finally, this study was informed by perspectives from economically distressed communities (as designated by the Denali Commission). I thought perspectives from these villages would reveal the greatest challenges to providing safe drinking water in all communities. Conducting studies to explore the perspectives of communities that do not fall under this label would be helpful to draw similarities and differences in terms of challenges they face. The final

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[6] Janice Levangie, "A bottom up approach to evaluate risk assessment tools for drinking water safety in First Nations communities" (University of Guelph, 2009).

purpose would be to inform the design of improved policies and technologies for water and sanitation service delivery across rural Alaska.

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Appendix A. Letter of Support signed by Jerry Isaac, Tanana Chiefs Conference

Tanana Chiefs Conference

Chief Peter John Tribal Building
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Fairbanks, Alaska 99701-4897
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SUBREGIONS

UPPER KUSKOKWIM
McGrath
Medfra
Nikolai
Takotna
Telida

LOWER YUKON
Anvik
Grayling
Holy Cross
Shageluk

UPPER TANANA
Dot Lake
Eagle
Healy Lake
Northway
Tanacross
Tetlin
Tok

YUKON FLATS
Arctic Village
Beaver
Birch Creek
Canyon Village
Chalkyitsik
Circle
Fort Yukon
Venetie

YUKON KOYUKUK
Galena
Huslia
Kaltag
Koyukuk
Nulato
Ruby

YUKON TANANA
Alatna
Allakaket
Evansville
Fairbanks
Hughes
Lake Minchumina
Manley Hot Springs
Minto
Nenana
Rampart
Stevens Village
Tanana

August 2, 2011

Letter of Support to Fatima Ochante

I would like to introduce you to Fatima Ochante, a University of Alaska Fairbanks graduate student who has traveled from Peru to study in Alaska. Fatima is working on a project to explore the facilitators and challenges our Interior Region communities face with regard to sustained access to safe drinking water and sanitation. She would like to conduct phone-interviews with utility administrators and water plant operators to learn more about this important issue. As you know, the Tanana Chiefs Conference is dedicated to providing a unified voice to advance our tribal governments by promoting physical and mental wellness, as well as environmental health. I believe the project Fatima has developed captures the rich values of our organization as we strive to serve Alaska's Interior Region. Bill Justice, Environmental Health Director at TCC, has reviewed Fatima's project. He supports her efforts, and is helping to identify potential interview participants.

I enthusiastically support Fatima's project. In the near future, she might call you to set up a date and time to conduct a phone-interview this summer. I strongly encourage you to give her your time and perspectives.

On behalf of the Tanana Chiefs Conference, I thank you for your consideration, and your participation in this important project.

Respectfully,

TANANA CHIEFS CONFERENCE

Jerry Isaac
President/Chairman

Tanana Chiefs Conference is a unified voice advancing Tribal governments, economic and social development, promoting physical and mental wellness, educational opportunities and protecting language, traditional and cultural values.

Appendix B. Interview Consent Information Sheet

Project title	**Sustaining rural water and sewer systems that promote local well-being in Alaska Native villages**
IRB Waiver #	235172-1
Village	
State	Alaska
Date	

The purpose of this study is to better understand the things that make it easy or hard for villages to access water and sanitation services, and how the public program supporting these services relates to local notions of healthy water and traditional values such as self-reliance. **You are being asked to take part in an interview** to discuss these topics. The interview will take about 1 hour, but might be shorter or longer depending on how much you would like to share. To thank you for your time, I would like to give you a free calling card.

What you have to say is important. Therefore **the interview will be audio taped.** To maintain confidentiality, your interview will be transcribed and the audio recording will be deleted. Although I might share some of the things you share with me, **your name will not be linked to this information**.

There are minimal risks in participating in this study. For example, you may feel uncomfortable about answering certain questions. But remember, you do not have to answer any question that you do not wish to answer.

Also, **there are no direct benefits to you in participating in this study**. Please note that by sharing your perspectives you will help educate others about this pressing issue (access to water and sanitation services in villages) as the findings of this study will inform educational publications and presentations.

Your decision to take part in this study is voluntary. You are free to choose not to take part in this study or to stop taking part at any time without penalty to you. If you have questions, feel free to ask them now. **If you have questions later, you may contact me using the information below.**

Lead investigator:
Fatima Ochante
c/o Northern Studies
P.O. Box 756460
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Fairbanks, AK 99775
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Faculty supervisor:
Dr. Chanda Meek
Department of Political Science
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University of Alaska Fairbanks
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Tel: (907) 474 5115
clmeek@alaska.edu

If you have questions or concerns about your rights as a study participant, please contact the Office of Research Integrity at 474-7800 (Fairbanks area) or fyirb@uaf.edu

Statement of Consent:

I understand the information described above. My questions have been answered to my satisfaction. I agree to participate in this study.

_____
NAME OF RESPONDENT GIVING ORAL CONSENT

_____
DATE

_____
SIGNATURE OF INTERVIEWER

Appendix C. Interview Guide

The interview questions will follow five major themes. Each theme or category will present a subset of questions that collectively will address the themed question. According to the respondents' answers, spontaneous follow up questions will be posed —whenever appropriate and possible— to fully address the major themed question and to elicit fully the respondents' insight. Finally, a few demographic data questions and a closing question will be posed.

1. **Category: What is considered to be healthy or safe water in a rural village?**

Specific Questions/Prompts:

How would you differentiate between healthy and unhealthy water in a village?

Would you judge by the source of water or the storage location, by the way it looks or tastes, or by the quantity available? Are there other considerations?

To secure healthy water in villages, how important do you think it is to have running water and flush toilets?

Do you think it's possible to have healthy water without these systems? (If yes, Could you give me any examples?)

So would you say that safe/healthy water is essential for community health/well-being in a village?

Do you think all village residents would want to have running water and flush toilets?

2. **Category: How does the public program for water and sanitation in rural villages work?**

Specific Questions/Prompts:

Could you tell me how the process develops in a village, whenever the community wants to introduce water and sewer systems or make upgrades and repairs to their systems? (What are the steps that rural residents take?)

When people have problems with water and sewer systems who do they go to? (inside/outside the village)

What are the key challenges in trying to keep up with the responsibilities that water and sanitation utilities bring?

Are there arguments against considering water and sewer systems a local priority? If so, what are they?

Think back over the past 5 years of the operations of these water and sewer systems. What went particularly well?

Are there any elements that didn't work?

Could they be improved? If so, how?

3. **Category: What do people understand by community health (well-being) in rural villages?**

Specific Questions/Prompts:

How would you define community health? Do you have a mental image of what a healthy community would look like?

Do you think this is the same or different definition that people in the community/ies you work in use? (How are they different?)

What role do water and sanitation utilities play in community health?

4. **Category: What is considered to be a self-reliant community in rural Alaska?**

Specific Questions/Prompts:

In the Interior, do Alaska Natives talk about self-reliance? If so, how?

Is there an Athabascan concept similar to "self-reliance"? How would you describe it?

Could you give me examples of why it would be so important?

(If not familiar with the Native concept, what do you think villages mean by self-sufficiency/self-reliance and would that be important?)

Are there critical skills or activities needed to remain self-reliant?

Would water and sanitation utilities contribute to a community's and individuals' self-reliance?

If yes, in which ways? / If no, why not?

5. **Category: How does the public program relate to self-reliance and community health (well-being)?**

Specific Questions/Prompts:

How is your village/tribe dealing with the responsibilities that come with sustaining water and sewer systems (e.g. utility administration, regulations compliance, operation and maintenance, user fees)? Could you tell me of any particular case?

Are these responsibilities increasing dependence on outside support?

Are these responsibilities getting in the way of other community priorities?

Imagine a community capable of sustaining water and sewer utilities without help from the state or federal government: How do you think the community made it possible?

Does the capacity of a village to sustain water and sanitation utilities say anything about the future welfare of the community?

6. **DEMOGRAPHIC INFORMATION**

Gender

Age

Occupation

What is the type of water and sewer systems you have at home (e.g. single watering point (washeteria), piped distribution (indoor plumbing), truck and haul system)

Educational background -- did you go to college, or where did you learn about public utilities (water and sewer)?

If you did go to college, what was your degree in?

Did you grow up in_____ [the village in question]? If not, where did you grow up?

7. CLOSING QUESTION

Of all the things we've talked about today is there any that is most important to you? Or are we missing anything?